

RECENT DEVELOPMENTS IN NASA'S COMMERCIAL CREW ACQUISITION STRATEGY

HEARING BEFORE THE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY HOUSE OF REPRESENTATIVES ONE HUNDRED TWELFTH CONGRESS SECOND SESSION

FRIDAY, SEPTEMBER 14, 2012

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CONTENTS

Friday, September 14, 2012

Witness List	Page 2
Hearing Charter	3

Opening Statements

Statement by Representative Ralph M. Hall, Chairman, Committee on Science, Space, and Technology, U.S. House of Representatives	10
Written Statement	11
Statement by Representative Eddie Bernice Johnson, Ranking Minority Mem- ber, Committee on Science, Space, and Technology, U.S. House of Rep- resentatives	
Written Statement	14
Statement by Representative Donna F. Edwards, Member, Committee on Science, Space, and Technology, U.S. House of Representatives	12
Written Statement	13

Witnesses:

Mr. William H. Gerstenmaier, Associate Administrator, Human Exploration and Operations Mission Directorate, National Aeronautics and Space Ad- ministration	
Oral Statement	16
Written Statement	19
Vice Admiral Joseph W. Dyer, USN (Ret.), Chairman, Aerospace Safety Advi- sory Panel	
Oral Statement	24
Written Statement	26

Appendix I: Answers to Post-Hearing Questions

Mr. William H. Gerstenmaier, Associate Administrator, Human Exploration and Operations Mission Directorate, National Aeronautics and Space Ad- ministration	52
Vice Admiral Joseph W. Dyer, USN (Ret.), Chairman, Aerospace Safety Advi- sory Panel	57

Appendix II: Additional Material for the Record

Submitted Statement for the Record by Representative Jerry Costello, Mem- ber, Committee on Science, Space, and Technology, U.S. House of Rep- resentatives	64
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**RECENT DEVELOPMENTS IN
NASA'S COMMERCIAL CREW
ACQUISITION STRATEGY**

FRIDAY, SEPTEMBER 14, 2012

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Committee met, pursuant to call, at 9:34 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Ralph Hall [Chairman of the Committee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Committee on Science, Space, and Technology
Recent Developments in NASA's Commercial Crew Acquisition Strategy
Friday, September 14, 2012
9:30 a.m.-11:30 a.m.
2318 Rayburn House Office Building

Witnesses

Mr. William H. Gerstenmaier,
Associate Administrator, Human Exploration and Operations Mission Directorate, National
Aeronautics and Space Administration

VADM Joseph W. Dyer, USN (Ret.)
Chairman, Aerospace Safety Advisory Panel



**COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES**

Recent Developments in NASA's Commercial Crew Acquisition Strategy

Friday, September 14, 2012
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

Purpose

NASA recently awarded more than \$1.1 Billion to three companies to develop competing concepts for human space transportation launch systems. This hearing will review NASA's rationale for selecting the three companies; consider the cost and safety implications of these recent decisions; and given the unique nature of Space Act Agreements, examine the level of NASA's insight and thus, its ability to evaluate technical and safety requirements.

Witnesses

Mr. William H. Gerstenmaier, Associate Administrator, Human Exploration and Operations Mission Directorate, National Aeronautics and Space Administration

VADM Joseph W. Dyer, USN (Ret.), Chairman, Aerospace Safety Advisory Panel

Introduction

NASA's commercial crew program is funding the development of multiple competing concepts for human spaceflight vehicles. With this program the government is stimulating aerospace companies to develop human spaceflight vehicles and systems that NASA hopes will eventually result in multiple, safe crew transportation options from which NASA can then purchase crew transportation services to ferry astronauts to and from the International Space Station by 2017. The program has been underway since 2010, allocating a total of \$366 Million among six companies in the first two phases.

On August 3, 2012, NASA selected three companies to receive a total of \$1.113 Billion in the third phase of the program, bringing the level of federal spending to nearly \$1.5 Billion. This third phase is known as Commercial Crew Integrated Capability (CCiCap) and runs thru May 2014. Optional milestones beyond May 2014, if exercised by NASA, will require additional funding. As with the two previous phases (CCDev1 & CCDev2), NASA is granting the money using Space Act Agreements (SAAs), instead of Federal Acquisition Regulations. According to NASA, SAA grants cannot be used to purchase anything for the "*direct benefit or use of the U.S. Government.*"¹

¹ Chiles Act: 31 USC 6303

Ultimately though, before NASA can purchase any transportation services from successful developers, it will have to certify that the systems are capable of performing NASA's missions and are safe enough to carry American and our international partner astronauts to the ISS.

Since the U.S. government will not *own* the vehicles, the designs, or the intellectual property, NASA plans to fund two follow-on contracts – contracts that conform to Federal Acquisition Regulations – to certify these systems before flight to ensure they meet NASA's technical and safety requirements. During the current phase of design, under an SAA, no NASA crew transportation system requirements can be levied on the commercial partners.² As a result, NASA cannot exercise the same level of insight it normally has in other technology development efforts. NASA has not been able to credibly estimate the expected total cost to certify the companies' designs, or the cost to buy launch services. To a large degree the per-seat cost will depend on the number, and financial strength of non-government purchasers that enter the market.

Background

On February 1, 2010, NASA initiated the first phase of its Commercial Crew Development program (CCDev1), using stimulus funds from the American Recovery and Reinvestment Act of 2009. With CCDev1 NASA awarded a total of \$50 Million using Space Act Agreements (SAA) to fund five competing companies. On April 18, 2011, NASA initiated the second phase (CCDev2), awarding a total of \$269.3 Million to four competing companies. On September 19, 2011, NASA granted an additional \$46.2 Million to two of the companies, bringing the total CCDev2 awards to \$315.5 Million.

The current (third) phase of the program is known as the Commercial Crew Integrated Capability (CCiCap). According to the solicitation the CCiCap strategic goals are as follows:

1. *Advancing multiple integrated crew transportation systems to an orbital crewed demonstration flight no later than the middle of the decade or as early as possible.*
2. *Achieving significant industry financial investment.*
3. *Achieving affordable development costs.*
4. *Providing the initial crew transportation system capability that will lead to long-term cost effective access to Low Earth Orbit.*
5. *Developing a capability to Low Earth Orbit that supports commercial markets for both commercial and Government customers.*

The overall safety goal was stated in general terms:

"Successful commercial human space flight demands the highest commitment to safety; therefore NASA has the goal of fostering a safety culture in the commercial space flight industry that ultimately will minimize the risks associated with human space flight to LEO. NASA's goal is for Participants to demonstrate safety processes that include strong inline checks and balances, healthy tension between responsible organizations, value-added independent assessments and appropriate data archival, which will increase Government confidence in the Participant's approach to safety."

² August 17, 2011 NASA letter to industry http://commercialcrew.nasa.gov/document_file_get.cfm?docid=249

NASA's goal for the Commercial Crew Development program is to stimulate the aerospace industry to develop multiple, competitive, privately operated, human spaceflight vehicles and systems. Although the government is paying for about 90 percent³ of this development, NASA will not *own* the vehicles or retain the designs, intellectual property, or data rights. Private entities will own and operate the vehicles and systems. Instead of the government specifying what is needed, the private entities will propose their designs, on their development schedule, with the hope of meeting NASA's objectives. NASA is not requiring any certified cost or pricing information. Further, NASA will delegate to the companies the responsibility to ensure that lower-tier suppliers provide components meeting specified performance requirements. In this way NASA will no longer control *how* the government's requirements are met, and instead give that responsibility to the private companies.

On August 3, 2012 NASA awarded Space Act Agreements to three different companies with a combined value of \$1.113 Billion. Boeing will receive \$460 Million, SpaceX will receive \$440 Million, and Sierra Nevada will receive \$212.5 Million. The CCIcap Space Act Agreements cover a base period of 21 months (ending in May 2014).

The following table, derived from the CCIcap Selection Statement⁴, illustrates NASA's final evaluation ratings.

NASA Evaluation Ratings		Sierra Nevada		ATK		Boeing		SpaceX	
		Tech.	Bus.	Tech.	Bus.	Tech.	Bus.	Tech.	Bus.
Effectiveness	Very High	X	X			X		X	X
	High				X				
	Moderate			X			X		
	Low								
	Very Low								
Confidence	High					X	X		X
	Medium	X	X		X			X	
	Low			X					

³ 90 percent is indicative of the approximate relative contribution of the Federal Government. The actual non-government cash or in-kind contributions of the commercial partners is proprietary information and varies by company, and may be greater or less than 10 percent of the total.

⁴ http://commercialcrew.nasa.gov/document_file_get.cfm?docID=645

The following table illustrates NASA's Commercial Crew program spending by company through the CCIcap base period to May 2014.

Commercial Crew Program \$'s in Millions (years)	CCDev1 (2010-2011)	CCDev2 (2011-2012)	CCiCap (2012-2014)	Total NASA (2010-2014)
Alliant Techsystems (ATK)		0.0		0.0
Blue Origin	3.7	22.0		25.7
Boeing	18.0	112.9	460.0	590.9
Excalibur Almaz		0.0		0.0
Paragon Space Development	1.4			1.4
Sierra Nevada	20.0	105.6	212.5	338.1
SpaceX		75.0	440.0	515.0
United Launch Alliance	6.7	0.0		6.7
Total	49.8	315.5	1,112.5	1,477.8

In addition to the funds shown above, the three companies selected for CCIcap submitted optional milestones, that include such big ticket items as launch and landing simulations, spacecraft qualification testing, crew escape system pad abort tests, purchasing launch vehicles necessary for demonstration flights, and crewed orbital test flights. The optional milestones have aggregate total cost estimates in the range of \$4.5 Billion, more than four times greater than the costs assumed for the CCIcap base period (2012-2014).

Updated Acquisition Strategy

Concurrent with the CCiCap awards NASA released the following updated acquisition strategy.

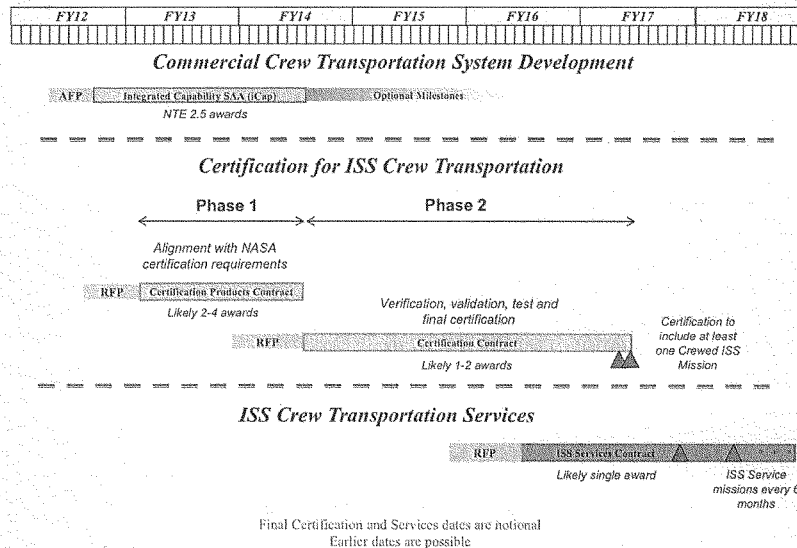


Figure 2: Overall CCP Roadmap

The three Space Act Agreements in the CCiCap phase are represented by the top bar in the figure above. NASA believes that during this time the companies will complete their integrated designs including the launch vehicle, crew-carrying spacecraft, and launch abort systems for crew safety. As mentioned earlier, no NASA requirements can be levied during the CCiCap phase, but it is increasingly apparent to NASA that ensuring that the systems developed during this process comply with NASA's requirements necessitates procurement contracts based on Federal Acquisition Regulations. If NASA waits too long to begin certification of a company's design, any necessary changes will likely be more complex and costly.

As a result, NASA has decided to begin initial certification activities in the near future – which are depicted in the figure above under the heading Certification for ISS Crew Transportation – and will use FAR-based procurement contracts. NASA plans to award two to four FAR-based fixed-price contracts in the first phase of certification known as the Certification Products Contract (CPC). The CPC period of performance will be approximately 15 months, with an expected award date in February 2013. According to NASA the CPC awards will not exceed \$10 Million per award, and the total value of all CPC awards is expected to be \$30-40 Million.

It is also important to note from the figure above that NASA is planning to buy ISS Crew Transportation Services at least one year *BEFORE* companies have completed NASA's certification. Therefore, it's unclear how NASA will know if these systems are safe.

Below is the schedule for NASA certification activities

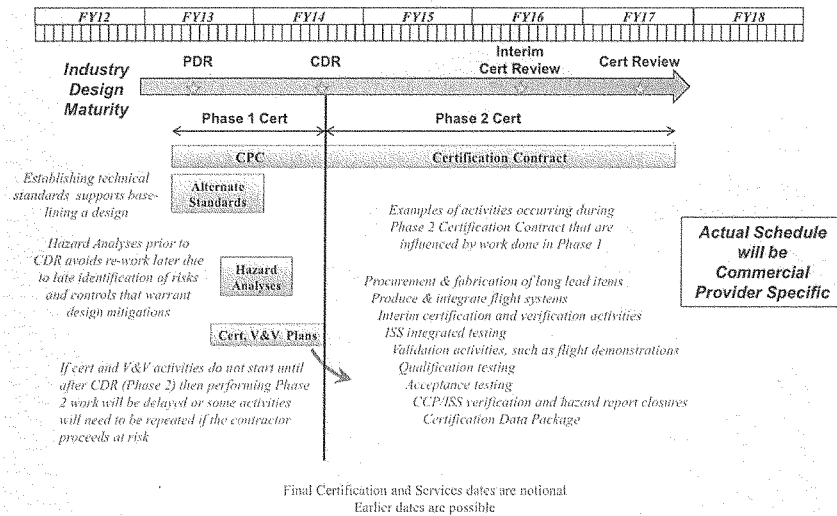


Figure 1: NASA's CTS Certification Activities

NASA hopes that by the end of the Phase 1 Certification that more than one company will have an integrated design sufficient to enter a Phase 2 competition leading eventually to a crewed ISS test mission.

Overarching Questions

- Does NASA's planned acquisition process provide the best value to the government?
- What are NASA's strategic goals for CCIcap, and were the CCIcap awards correctly evaluated against NASA's stated strategic goals?
- Do the goals reflect the needs of the government and our international partners for access to ISS?
- Will this process result in the safest, most efficient, human spaceflight vehicle to meet the government's needs to service the International Space Station?
- Why is NASA planning to award crew transportation contracts before the systems are certified for NASA's mission? How much increased cost and risk does the government assume as a result of this decision?

Appendix 1



Commercial Crew Program Appropriated Budget Compared to Fiscal Year (FY) Obligations

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Notional				TOTA
President's Budget Request	0.0	0.0	500.0	792.8	829.7	829.7	829.7	829.7	829.7	
Original Commercial Crew Appropriations	51.1	0.0	312.0	406.0						
Operating Plan Adjustments		0.1	9.4	-14.0						
Total Commercial Crew*	51.1	0.1	321.4	392.0	829.7	829.7	829.7	829.7	829.7	491.0
Obligations by FY**	0.0	51.2	302.0	411.4	829.7	829.7	829.7	829.7	829.7	491.0
Unobligated Roll Through	51.1	0.0	19.4	0.0	0.0	0.0	0.0	0.0	0.0	

Explanation of FY 2009 Unobligated Roll Through: The FY 2009 appropriation for Commercial Crew was part of the American Recovery and Reinvestment Act of 2009. The funds were not made available to the program until August 2009.

Explanation of the FY 2011 Unobligated Roll Through: In the June 2012 Operating Plan (approved July 2012), FY 2011 Commercial Crew funding was increased by \$14M and the FY 2012 funding was decreased by \$14M. As of September 30, 2011, there was only \$5.4M of unobligated FY 2011 funds. Due to the reprogramming in the June 2012 Operating Plan, the FY 2011 unobligated increased by \$14M. The funds carried over into FY 2012 included program support costs such as civil servant labor to support CCDEV2 and CCiCap.

* "Total Commercial Crew" line reflects the latest Operating Plans through FY 2012 and the FY 2013 President's budget request for FY 2013 through FY 2017; in FY 2010, \$0.1M was transferred from Commercial Cargo to Commercial Crew to ensure continuity of operations under a FY 2011 continuing resolution. Current House markup provides \$500M and current Senate markup provides \$525M in FY 2013.

** Commercial Crew has obligated \$383.1M in FY 2012 through August 2012. They are planning to obligate the remaining \$28.3M in September 2012 for a total of \$411.4M. Future obligations have been estimated using our current acquisition schedule.

In future years, Commercial Crew anticipates obligating the majority of the funds within the same year as appropriated.

Chairman HALL. The Committee on Science, Space, and Technology will come to order. I say good morning and welcome to today's hearing entitled "Recent Developments in NASA's Commercial Crew Acquisition Strategy." In front of you are packets containing the written testimony, biographies and the Truth in Testimony disclosures for today's witnesses. And we certainly thank all of you for your preparation time, your traveling time and for the time you are giving us here today. We will have opening statements, and I recognize myself for five minutes for an opening statement.

Before we begin today, I want to take a moment to pay tribute to a true hero, and I know it is a tribute all of us would pay, and a very dear friend, Neil Armstrong, who was memorialized yesterday in a very moving ceremony at the National Cathedral. He has been before this Committee a lot of times and he was an inspiration to everyone, a hero throughout the world, and yet one of the most honorable and gracious men you have ever known or ever met. I had the pleasure of having him in my home in late August, and the thing I treasure more than anything, his letter back several days later that I didn't really receive, didn't find its way through Washington through Texas to my office in Rockwell, my home in Rockwell for some time.

On several occasions he appeared before this Committee. His first step, I don't say anything here that you don't know, and you were listening, you heard it yesterday, a lot of it, established our preeminence in space, and I think it got old to him to hear people introduce him as the Columbuses and the Magellans of space, but that is exactly what they were. Neil was just really an advocate for preserving our leadership, and I know my colleagues join me in working to carry out his legacy. We will also be inspired by his very remarkable life and forever honor him for his place in American history. People will be reading about him and value very much the pictures they have with him though they didn't get an autograph with most of them in his latter years. I think he got a little sick of people getting his autograph and going and selling it for a thousand bucks or so.

And I want to thank our witnesses for being with us today. I know you treasured his recognition yesterday and the memory that we have of him.

I will get underway with my statement. NASA recently awarded more than \$1.1 billion to three companies to develop competing concepts for human space transportation launch systems. Today's hearing is going to review NASA's rationale for selecting the three companies, to consider the cost and safety implications of these recent decisions, and given the unique nature of Space Act Agreements, examine the level of NASA's insight and thus its ability to evaluate technical and safety requirements.

Our Nation has made great strides in space exploration but these strides have not come without cost and without sacrifice. We have lost astronauts. After the Columbia accident, President Bush and Congress put our Nation and absolutely put us on a path to develop new human space transportation systems that were designed from inception to be safer than the space shuttle. Safety was very big, of course. NASA responded with the Constellation system. But

this Administration has chosen a different path. NASA now seeks to use government funds to stimulate aerospace companies to develop multiple, competing human spaceflight systems, systems for which NASA may be the only customer. Are these systems designed from inception to be safer than the space shuttle, or is NASA responding to different goals? How and when will we know the safety of these new systems?

NASA is using Space Act Agreements, not regular contracts, giving the companies great flexibility to do as they see fit, in fact, so much flexibility that during this phase no NASA crew transportation system requirements can be levied. It is hard for me to understand why NASA is proceeding this way. Will this result in systems that are safe for our American and international partner astronauts? How will NASA know if they don't have the insight? And perhaps more importantly to those of us in Congress who are asked to fund this, how and when will NASA know if it is getting what it needs and if these systems will be safe enough? Redesigns will be costly and time consuming if important technical or safety requirements were not addressed up front, which I think they should be.

If our Nation is going to ask crews to explore space, it is our responsibility to do everything possible to ensure that those astronauts return to Earth safely. I am not convinced this approach is the right one but I am willing to listen.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF CHAIRMAN RALPH HALL

Good morning, and welcome to today's hearing. Before we begin today, I want to take a moment to pay tribute to a true hero and a dear friend, Neil Armstrong, who was memorialized yesterday in a moving ceremony at the National Cathedral.

Neil Armstrong was an inspiration to all Americans, a recognized hero throughout the world—and yet one of the most humble and gracious men you ever met. On several occasions Neil appeared before this Committee to offer his wisdom and insight, deflecting praise and questions with grace and humility.

Neil's first step on the Moon established America's preeminence in space and paved the way for scores of spectacular missions involving hundreds of outstanding Astronauts. Neil was one of the most impassioned advocates for preserving America's leadership in space and constantly challenged us to strengthen human space exploration goals and missions. I urge my colleagues to join me in working to carry out his legacy. We will forever be inspired by his remarkable life and forever honor him for his place in American history.

I want to thank our witnesses for being with us today. I know a lot of time and effort goes into your preparation but your knowledge and experience is very important to us, so thank you for taking the time to appear today.

NASA recently awarded more than \$1.1 billion to three companies to develop competing concepts for human space transportation launch systems. Today's hearing will review NASA's rationale for selecting the three companies; consider the cost and safety implications of these recent decisions; and given the unique nature of Space Act Agreements, examine the level of NASA's insight and thus, its ability to evaluate technical and safety requirements.

Our nation has made great strides in space exploration. But those strides have not come without cost and sacrifice. We have lost astronauts. After the Columbia accident President Bush and Congress put our nation on a path to develop new human space transportation systems that were designed from inception to be safer than the Space Shuttle. NASA responded with the Constellation system. But this Administration has chosen a different path. NASA now seeks to use government funds to stimulate aerospace companies to develop multiple, competing human spaceflight systems—systems for which NASA may be the only customer. Are these systems designed from inception to be safer than the space shuttle, or is NASA responding to different goals? How and when will we know the safety of these new systems?

NASA is using Space Act Agreements—not regular contracts—giving the companies great flexibility to do as they see fit. In fact so much flexibility that during this phase no NASA crew transportation system requirements can be levied. It's hard for me to understand why NASA is proceeding this way. Will this result in systems that are safe for our American and international partner astronauts? How will NASA know if they don't have the insight? And perhaps more importantly to those of us in Congress who are asked to fund this, how and when will NASA know if it is getting what it needs and if these systems will be safe enough. Redesigns will be costly and time consuming if important technical or safety requirements were not addressed up front.

If our nation is going to ask crews to explore space, it is our responsibility to do everything possible to ensure that those astronauts return to Earth safely. I'm not convinced this approach is the right one but I'm willing to listen.

Chairman HALL. At this time I recognize Ms. Edwards for her opening statement.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you for your words about Neil Armstrong. It really was quite a moving tribute in celebration of his life yesterday, and I think for those of us, whether we were mature back then or were just little girls in school, it made us come to appreciate the desire and willingness to explore uncharted territory, and I think has made me anyway as infectious about NASA and the space program as I have ever been.

I want to thank our witnesses this morning and look forward to your testimony. And as my colleagues know, I am a strong supporter of NASA, both the science programs and the human spaceflight activities. I also am keenly interested in and excited by the entrepreneurial energy that is being devoted to human spaceflight these days. The passion of those working on commercial approaches to human spaceflight is indeed infectious, and as I have said before—no great secret—I want to be there myself. I want to fly.

But that said, in my capacity as a member of this Committee, I have a responsibility, as we all do, to scrutinize each of NASA's major projects to make sure that they are well planned and executable. NASA's Commercial Crew Program has to be subjected to that same level of oversight and scrutiny if we are to do our jobs on this Committee.

In that regard, I am concerned that NASA may not be holding that program, the Commercial Crew Program, to the same standard as other major acquisitions. Make no mistake: this is a major acquisition for NASA. When the taxpayer is footing the bill, paying on average 9 out of every 10 dollars that is being spent to develop these commercial crew vehicles, we are not talking about a straightforward purchase of commercial services from the GSA list. These services don't even exist yet.

I am puzzled and a bit frustrated that NASA appears to be unable or unwilling to acknowledge the warning signs that this major program is not on a firm path to success at present, and I look forward to hearing from our witnesses about that. In that regard, the written testimony of the Chair of the Aerospace Safety Advisory Panel, ASAP, Admiral Dyer, is illuminating. While his prose is cautious and understated, it is hard not to read the concern couched in such statements as, and I quote, "Lacking an independent cost estimate, we are uncertain as to affordability," and continuing the quote, "However, we arrive at this point in time with designs that are maturing before requirements, and where government and in-

dustry have not yet agreed on how winning designs will be accepted and certified. We worry that the cart is ahead of the horse,” and he continued, “NASA is just now undertaking to determine how systems will be certified to transport NASA astronauts. This timing increases programmatic risk and has serious potential to impact safety.”

And so to that, I would add some of my own concerns, namely that not only do we not have an independent cost assessment to guide our Congressional deliberations, we don’t have independent assessment of when these commercial systems will actually be able to start operational service to the International Space Station. NASA is saying “in the 2017 timeframe” in Mr. Gerstenmaier’s testimony, and even 2018 in one of its notional planning charts, and I would note that both of those dates are within just a few years of the currently scheduled end of Space Station operations and years later than originally promised. Moreover, both of those dates appear to be based on assumed funding levels for the Commercial Crew Program that don’t seem to bear much resemblance to what Congress has authorized or appropriated so far, or is likely to approve in the foreseeable future. If that is true, then I think we need NASA to give us a cost and schedule estimate that is based on more realistic budgetary assumptions, so we can see what is most likely to actually happen, something we require for all other NASA major programs.

In addition, NASA still has not given Congress a clear understanding of how much it will cost to fly our astronauts on these commercial systems. It is reported that NASA has had an independent assessment that estimates that NASA’s commercial crew seats are likely to be several times as high as Soyuz costs. If that is true, and I want to know whether it is true, we need to know.

And finally, as alluded to in Admiral Dyer’s testimony, NASA’s latest approach to acquiring those commercial crew systems is, to put it charitably, “complex and unique.” Trying to run Space Act Agreements in parallel to FAR-based contracts may be a workaround, as the ASAP testimony phrases it, but that begs the question of why NASA didn’t just stick to its original plan for FAR-based contracting.

So we have much to talk about today. And as I close, I want you to know how much I appreciate the service that is rendered to this Committee and to the Nation on a continuing basis by the gentlemen appearing before us today. Both of you really have difficult jobs, and we appreciate your efforts, and thank you very much.

[The prepared statement of Ms. Edwards follows:]

PREPARED STATEMENT OF REPRESENTATIVE DONNA F. EDWARDS

Good morning, and welcome to our witnesses. I look forward to your testimony. As my colleagues know, I am a strong supporter of NASA, both its science programs and its human spaceflight activities. I also am keenly interested in and excited by the entrepreneurial energy being devoted to human spaceflight these days. The passion of those working on commercial approaches to human spaceflight is infectious—and as I’ve said before, I’d love to fly into space myself someday!

That said, in my capacity as a Member of this oversight Committee, I have a responsibility to scrutinize each of NASA’s major projects to make sure that they are well planned and executable. NASA’s commercial crew program has to be subjected to that same level of oversight if we are doing our jobs on this Committee.

In that regard, I have to say that I am concerned that NASA is not holding that program to the same standard as its other major acquisitions. And make no mistake—this is a major acquisition for NASA. When the taxpayer is paying on average nine out of every ten dollars being spent to develop these commercial crew vehicles, we are not talking about a straightforward purchase of commercial services from the GSA list—these services don’t even exist yet.

That said, I am puzzled and a bit frustrated that NASA appears to be unable or unwilling to acknowledge the warning signs that this major program is not on a firm path to success at present. In that regard, the written testimony of the Chair of the Aerospace Advisory Panel (ASAP), Admiral Dyer, is illuminating. While his prose is cautious and understated, it is hard not to read the concern couched in such statements as:

“Lacking an independent cost estimate, we are uncertain as to affordability.”

“However, we arrive at this point in time with designs that are maturing before requirements, and where government and industry have not yet agreed on how winning designs will be accepted and certified. We worry that the cart is ahead of the horse,” and

“NASA is just now undertaking to determine how systems will be certified to transport NASA astronauts. This timing increases programmatic risk and has serious potential to impact safety.”

To that I would add some of my own concerns, namely that not only do we not have an independent cost assessment to guide our congressional deliberations, we don’t have any independent assessment of when these commercial systems will actually be able to start operational service to the International Space Station. NASA is saying “in the 2017 timeframe” in Mr. Gerstenmaier’s testimony and even 2018 in one of its notional planning charts—and I would note that both of those dates are within just a few years of the currently scheduled end of Space Station operations—and years later than originally promised. Moreover, both of those dates appear to be based on assumed funding levels for the commercial crew program that don’t seem to bear much resemblance to what Congress has authorized or appropriated so far, or is likely to approve in the foreseeable future. If that’s true, then I think we need NASA to give us a cost and schedule estimate that is based on more realistic budgetary assumptions, so we can see what is most likely to actually happen—something we require for all of NASA’s other major programs.

In addition, NASA still has not given Congress a clear understanding of how much it will cost to fly our astronauts on these commercial systems. It is reported that NASA has had independent assessments that estimate that NASA’s commercial crew seat costs are likely to be several times as high as Soyuz costs. Is that true? We need to know.

And finally, as alluded to in Admiral Dyer’s testimony, NASA’s latest approach to acquiring these commercial crew systems is, to put it charitably, “complex and unique.” Trying to run Space Act Agreements in parallel to FAR-based contracts may be a “workaround,” as the ASAP testimony phrases it, but that begs the question of why NASA didn’t just stick to its original plan for FAR-based contracting.

Well, we have much to talk about today. As I close though, I would like to say that I deeply appreciate the service rendered to this Committee and to the nation on a continuing basis by the two gentlemen appearing before us today. You both have very hard jobs, and we appreciate your efforts.

Thank you, and with that I yield back the balance of my time.

Chairman HALL. The gentlelady yields back.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF RANKING MEMBER EDDIE BERNICE JOHNSON

Good morning. I would like to join Chairman Hall in welcoming our witnesses to today’s hearing. You both have served the nation well in a number of capacities over the years, and we appreciate your dedication.

I will try to be brief in my opening comments. It was a little less than a year ago that this Committee held its most recent hearing on NASA’s commercial crew program. At that time, I raised a number of concerns and questions that I believe Congress needed to have addressed if we were to adequately pass judgment on

NASA's plans and protect the interests of the taxpayer. A year later most of those questions and concerns remain.

I had hoped that in the intervening time, NASA would either converge on a realistic and executable plan within likely funding levels that could provide safe, affordable, and timely commercial crew transportation services to the International Space Station—or alternatively, determine that it couldn't do so with a high likelihood of success within the available funding and then look for other ways of meeting its crew transportation needs.

Unfortunately, NASA has done neither.

Instead of converging on an executable plan, NASA has shifted its acquisition approach multiple times and now is proposing to carry out two distinct acquisition approaches in parallel. It has persisted in basing its program on budgetary assumptions that appear to be unrealistic based on both the authorizations and appropriations provided to date and the fiscal outlook facing the agency. And it still does not appear to have achieved a consensus within the agency on whether the primary purpose of the program is to provide crew transport to the ISS as soon as possible or to attempt to create a new commercial crew industry that doesn't currently exist.

While I hope that I am wrong, those don't appear to be the characteristics of a program that is headed in a successful direction. And I see other symptoms of a program in trouble. First, despite repeated requests by this Committee and concerns voiced by the Aerospace Safety Advisory Panel, NASA still has not had an independent cost and schedule assessment conducted for the commercial crew program, so we still do not know what the ultimate cost to the American taxpayer is likely to be, or when these systems are likely to become operational.

Second, while a number of Members have supported the program because they do not like the idea of paying the Russians to transport our astronauts to the ISS, NASA has been unable to provide any evidence to indicate that the cost per seat to NASA will be any lower than the costs it incurs with the Russians. Instead, a number of the analyses done for NASA to date indicate that NASA's cost per seat from commercial providers could be several times higher than the prices charged by the Russians.

Third, while one of NASA's stated goals for its commercial crew program is "Achieving significant industry financial investment," based on Committee staff calculations the recently awarded Space Act Agreements demonstrate that the companies selected are only willing to contribute an average of just 11% of the cost of developing the commercial crew systems—systems that the government will then also have to pay to use. I'm not sure I can explain to my constituents why they should consider that a fair arrangement.

Finally, although I think most Members believe the primary justification for the commercial crew program is to provide crew transportation to the ISS as soon as possible, NASA's own planning charts now show operational commercial crew transportation services to the ISS not starting until 2018—not the 2015 or 2016 dates agency officials were originally predicting—and only two years from the currently scheduled end of the Space Station program. Even that 2018 date appears to be based on funding levels from here on out that are not likely to be achieved.

Well, I'm sorry that I can't give a more positive assessment today. I really am excited by the work that the companies have done to date, and I certainly wish them well. However, as I said at last year's hearing, I can't let my enthusiasm for entrepreneurship override my responsibility to take a clearheaded look at NASA's plans. I owe that to my constituents and to all of the American taxpayers.

I will just close by again thanking our witnesses, and I look forward to your testimony. With that, I yield back the balance of my time.

Chairman HALL. At this time I am honored to get to introduce the panel of witnesses. Our first witness is Mr. William H. Gerstenmaier, a very capable Associate Administrator of Human Exploration and Operations Mission Directorate at the National Aeronautics and Space Administration. Mr. Gerstenmaier began his career at NASA in 1977 after graduating from Purdue University with a bachelor of science degree in aeronautical engineering. He has been before this Committee on many occasions. We have sought his advice. He has always been generous with it. During his tenure at NASA, he has led a number of activities associated with the shuttle, International Space Station and the shuttle Mir. Mr. Gerstenmaier has received a number of awards at NASA including the Presidential Rank Award for Meritorious Executives, and I welcome you once again, Mr. Gerstenmaier.

Our second witness is retired U.S. Navy Vice Admiral Joseph W. Dyer, Chairman of the Aerospace Safety Advisory Panel. Admiral Dyer served a long and distinguished career in the United States Navy. He received his wings in 1971. He progressed through the ranks, eventually obtaining the position of Chief Test Pilot and Program Manager for the F-18 program, and from 2000 to 2003 served as Commander of the Naval Air Systems Command. Today he is a Senior Executive with the iRobot Corporation. Welcome, Admiral Dyer. We are very delighted to have you with us here today.

As our witnesses should know, spoken testimony is limited to five minutes after which the members of the Committee will have five minutes each to ask questions. We will be generous with that with the value of your presentation here and your gift of your time, getting ready to come here and testify.

I now recognize the witness's to present their testimony. Mr. Gerstenmaier, you are recognized for five minutes, sir, to present your testimony.

**STATEMENT OF MR. WILLIAM H. GERSTENMAIER,
ASSOCIATE ADMINISTRATOR, HUMAN EXPLORATION AND
OPERATIONS MISSION DIRECTORATE,
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

Mr. GERSTENMAIER. Thank you.

I had the privilege of working with the teams that are developing and operating the systems that support human spaceflight. The teams take this responsibility very seriously. This is a tremendous responsibility and honor. These teams are doing their best to deliver and operate systems in efficient, effective, safe and cost-effective manners. The teams also recognize the sacrifices made by this Nation to provide NASA the funds necessary to pursue these endeavors. The teams believe the sacrifices made by the Nation will enable a better future.

Sometimes folks like to talk about our development activities, commercial and traditional, as separate, unrelated activities. There have been two hearings this week, one on examining NASA's development of the Space Launch System and Orion crew capsule, and today's hearing, "Recent Developments in NASA's Commercial Crew Acquisition Strategy." I look at these as related activities and both in support of human spaceflight. The Commercial Crew Program is important to the International Space Station program. We need redundant crew transportation and rescue capability as soon

as possible. We need to back up crew transportation for this remarkable facility, the International Space Station. We have similar redundancy in cargo. We have different providers for cargo, and we need the same for crew. We need a very different system to enable exploration beyond low-Earth orbit, that is, for SLS and Orion. It has different technical capabilities.

The current budget environment is making developing two systems, crew for ISS and the SLS–Orion for beyond low-Earth orbit a challenge. Both of these programs are needed for a human spaceflight program. We need to look at these programs supporting each other and ultimately the human spaceflight program for the Nation. The human spaceflight program in combination with NASA’s scientific robotic exploration program is providing a motivation for innovation, creativity and provides the Nation a chance to inspire students to pursue technical careers.

My written testimony covers many of the recent events in Commercial Crew Program. We recently have made the Commercial Crew Integrated Capability Space Act Awards. The teams have completed requirement development for crew transportation. We have developed an overall strategy that uses Space Act and contracts. This strategy is outlined in a white paper that is publicly available. Two days ago, we put out a request for proposal for the first phase of the contract that will develop crew transportation for ISS. This is the first award of the first phase of a two-phase contract that we intend to award in February of 2013. We are still finalizing the details of our overall strategy in the outyears.

And then we also put a white paper that describes our approach to certifying the designs for crew transportation, and this white paper is not to be confused with the white paper on acquisition strategy. This white paper talks about how we are going to actually certify the designs and how we maintain waivers, et cetera, and ensure the safety of the requirements that are in place, and we are looking for comments to this white paper that was recently released.

We have listened to many outside expert advisors and built a sound strategy to deliver capability for this Nation in a cost-effective and safe manner. The approach to this program is different than past programs but shares many similarities. We have learned from previous activities and are putting that learning to work. We are also taking lessons from the commercial crew and applying those back to SLS and Orion. I am sure we will learn more as we progress. We are innovating as best that we can. It will not be easy developing a system to safely carry crew to the ISS. The teams have made tremendous progress in the last year. We still have many challenges ahead understanding the fiscal year 2013 budget, completing phase one awards for the certification acquisition, monitoring progress of our commercial providers as they head towards a critical design review level of maturity, and refining the outyear acquisition strategy. We will listen to the outside advisors and take their advice into consideration.

I continue to watch the NASA team deliver programs and products that others thought impossible. With proper support from all of us, the NASA team will deliver a safe U.S. crew transportation system for the ISS.

I look forward to your questions. Thank you.
[The prepared statement of Mr. Gerstenmaier follows:]

HOLD FOR RELEASE
UNTIL PRESENTED
BY WITNESS
September 14, 2012

**Statement of
William H. Gerstenmaier
Associate Administrator for Human Exploration and Operations
National Aeronautics and Space Administration**

before the

**House Science, Space, and Technology Committee
U.S. House of Representatives**

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you today to discuss the newest phase of NASA's Commercial Crew Program (CCP). We are committed to launching our crew from U.S. soil on spacecraft built by American companies as soon as possible. This program is good for NASA, the American taxpayer, and the U.S. economy. American commercial crew transportation and emergency return services will enable the United States to fly its own astronauts to and from the International Space Station (ISS), end our sole reliance on foreign governments, increase the ISS crew complement to 7 from 6, enable increased ISS research utilization, and allow NASA to focus on deep space exploration. The ISS is a tremendous national resource and having dissimilar redundancy in crew transportation is critical to effective utilization of ISS. Cargo transportation has dissimilar redundancy with four independent systems capable of ISS cargo resupply (Progress, ATV, HTV, and Dragon). For ISS crew transportation, we have only a single system – the Soyuz. Lastly, the providers of these crew transportation services will also be able to market their low-Earth orbit transportation services to other non-NASA customers, thus improving the U.S. position in commercial space launch services.

NASA is very pleased with the progress our commercial space industry partners have made and continue to make in the development of crew and cargo transportation systems to date. SpaceX's demonstration flight to the Station in May 2012 achieved all of its test objectives enabling regular cargo resupply missions to be performed to the ISS. Moreover, the mission was completed at significantly less cost to the American taxpayers than if we had pursued a traditional, cost-plus development contract approach, and provides further confidence in our commercial space transportation strategy. Orbital Sciences is following close behind, with test flights of its Antares rocket and Cygnus cargo spacecraft and their own demonstration mission to the Station planned in the months ahead. In the Commercial Crew Program, our four funded CCDev 2 partners Blue Origin, Sierra Nevada Corporation, SpaceX and Boeing, and our three unfunded partners United Launch Alliance, ATK and Excalibur Almaz, have successfully

completed almost all of the planned milestones, with only four remaining to be accomplished by the end of the year. These milestones included major risk-reduction testing such as engine firings, parachute drop tests, astronaut evaluations, and wind tunnel tests, in addition to numerous technical design and safety reviews.

On August 3rd, NASA announced three new agreements with American commercial companies to design and develop the next generation of U.S. human spaceflight capabilities. Known as Commercial Crew Integrated Capability, or “CCiCap,” these newly signed agreements will enable advances that are intended to ultimately lead to the availability of commercial human spaceflight services for government and commercial customers.

Under CCiCap, industry partners will advance the integrated critical design of their planned crew transportation systems, including the crew spacecraft, launch vehicle, ground systems, and mission control capabilities. The agreements commence with a 21 month base period that will run from August 2012 through May 2014, which includes completing major design efforts and risk reduction demonstrations, propulsion testing, abort tests, and landing tests. This 21 month period will lead to approximately a critical design review level of maturity for two of these companies. The agreements also include proposed optional milestones beyond the base period, which NASA may fund incrementally, as needed. The information provided in support of these optional milestones will be important to improving our cost models for development under this new system of acquisition.

The companies selected for CCiCap agreements are:

- The Sierra Nevada Corporation, of Louisville, Colorado
- Space Exploration Technologies (SpaceX), of Hawthorne, California, and
- The Boeing Company, of Houston, Texas

Sierra Nevada will continue maturing their Dream Chaser spacecraft to be launched on an Atlas V rocket, while focusing on safety analysis and subsystem technology maturation/risk-reduction. The Dream Chaser is a reusable, piloted lifting body, derived from NASA’s HL-20 concept. It will glide to landings on a runway, similar to the Space Shuttle. Their agreement includes nine base period milestones, and is worth \$212.5 million if all milestones are accomplished. Notable milestones include further atmospheric flight testing of the Dream Chaser engineering test article, two integrated system safety analyses, wind tunnel testing, and propulsion systems testing.

SpaceX is maturing its Falcon 9/Dragon transportation system, focusing on developing an integrated, side-mounted launch abort system and other crew systems. The un-crewed version of the Dragon capsule has already been demonstrated as part of the Commercial Orbital Transportation System (COTS) program, and will be used operationally as part of the ISS cargo

resupply services effort beginning later this year. However, changes will be required for the cargo version to meet the requirements necessary to carry crew. The crewed version of the Dragon will land on land. SpaceX's fourteen base period milestones are valued at \$440 million, and include pad and in-flight abort flight tests, primary structure qualification, and an integrated system critical design review.

Boeing will continue developing its "CST-100" crew spacecraft, to be launched on an Atlas V initially, but capable of launching on other rockets. The CST-100 is a capsule-based spacecraft that leverages proven flight components. It will be reusable for up to ten missions and utilize airbags to enable land-based landings. Boeing's agreement includes \$460 million for nineteen base period milestones including wind tunnel testing, a production design review, propulsion systems testing, a pilot-in-the-loop demonstration, and an integrated system critical design review.

NASA is confident that these agreements for CCIcap will provide a cost-effective approach by which the partners can be innovative, creative, safe, and flexible in their design solutions to develop a commercial LEO crew transportation capability, while still maintaining competition for future stages of the program.

Overall Commercial Crew Program Strategy

NASA has a two-fold strategy to end the United States' sole reliance on foreign crew transportation to the International Space Station and utilize a safe, cost-effective U.S. Crew Transportation System (CTS) as soon as we are able to certify those systems to carry NASA astronauts.

- NASA is using Space Act Agreements under the CCIcap phase to support the design and development of commercial crew transportation capabilities, as outlined above.
- NASA will use FAR-based contracts for the certification of commercially developed capabilities and for the procurement of crew transportation services to and from the ISS to meet NASA requirements.

NASA is committed to ensuring that the requirements, standards, and processes for CTS certification for all commercial missions are held to the same or equivalent safety standards as Government human spaceflight missions. NASA certification will cover all aspects of a crew transportation system, including: development, test, evaluation, and verification; program management and control; flight readiness certification; launch, landing, recovery, and mission operations; sustaining engineering, and maintenance/upgrades. To ensure NASA crew safety, NASA certification will validate technical and performance requirements, verify compliance with requirements at the subsystem, process, and safety levels, validate that the CTS operates in the appropriate environments, and quantify residual risks.

NASA has determined that FAR-based contracts are needed for ISS service missions and has decided to begin the initial certification efforts immediately to enable the earliest possible crew transportation. If NASA were to delay certification activities, the development of industry's capabilities could eventually reach the point where any changes necessary to meet NASA requirements would not be technically feasible or affordable, potentially extending our reliance on foreign systems.

To mitigate these risks, NASA is moving forward immediately with plans to compete and award 2-4 FAR-based fixed-price contracts in CTS Certification Phase 1 that will begin early NASA-managed certification activities. These contracts are referred to as Certification Products Contract(s) (CPCs). The deliverables will include early life-cycle certification products (alternate standards, hazards analysis, and verification, validation, and certification plans). The period of performance will be approximately 15 months, with an expected award date in February 2013. CPC awards will not exceed \$10 million per award.

At the conclusion of the CPC, NASA anticipates that more than one commercial provider will have achieved the technical maturity of an integrated critical design state to enable a Phase 2 competition for the CTS Certification Contract. A separate, formal solicitation (RFP) will be released for the Phase 2 Certification Contract. Under NASA's planned strategy, the Phase 2 CTS Certification Contract will include development, test, evaluation, and certification activities enabling NASA to assess the CTS capability for performing ISS missions in compliance with NASA requirements to ensure NASA CCP mission and safety objectives are achieved. To provide an incentive to any commercial provider who is successful in achieving CTS Certification, the Phase 2 contract will include, as options, a nominal number of crewed missions to the ISS following successful CTS Certification. NASA believes that having more than one contractor through Phase 2 would provide significant advantages for insuring safe and affordable CTS through competition. The ultimate number of awards will be driven by technical maturity, funding availability, and mission needs. An acquisition strategy white paper has been developed that lays out the strategy for these procurement activities. The whitepaper can be accessed from the Commercial Crew Program website (<http://commercialcrew.nasa.gov/>) under the "Program Forum" link.

Phase 2 Certification activities will then lead to a competitive acquisition for the provision of commercial ISS transportation services using FAR-based, fixed-price contracts, similar to the manner in which NASA has contracted for commercial cargo services. Based on the information the Agency has received to date and assuming reasonable budget levels and technical progress, we believe that this acquisition strategy can enable services beginning in the 2017 timeframe. This estimate takes into consideration not only the schedule plans of our current industry partners, but also the NASA certification work described above. Beginning CCIcap now, and awarding the CPCs by early 2013, will ensure we stay on track for achieving the 2017 goal. We recognize that some of the industry providers are aiming at a service date earlier than 2017 and we will be able to take advantage of an earlier date if it occurs.

Conclusion

Following the example of many successful industries in the past, the United States is now entering a new era in spaceflight that harnesses the innovation and ingenuity of the private sector. This capability will provide cargo and crew access to LEO, while NASA once again pushes the boundaries of human exploration. The ISS has now entered its intensive research phase, and this phase will continue through at least 2020. In order to realize the promise of this facility, NASA will be relying on U.S. industry to provide cargo resupply, return and disposal services, as well as crew transportation and emergency return services. While there are still challenges ahead, the recent success of the SpaceX COTS demonstration mission is a harbinger of the potential of procuring transportation services from private entities.

Human spaceflight is a very difficult endeavor and achieving routine commercial crew transportation is a challenge, but NASA is structuring an approach that provides the highest probability of success. NASA's current path is a solid approach for developing and acquiring crew transportation services in a manner that is cost-effective and provides for crew safety. Procuring commercial crew transportation services from U.S. industry will allow NASA to focus its resources on the development of vehicles that will take our astronauts beyond LEO for the first time since 1972, furthering the legacy of the late Neil Armstrong and building on the incredible recent successful landing of the Mars Science Laboratory *Curiosity* rover on the surface of Mars. Support to this activity is also critical to ISS, which is key to the future of human spaceflight. ISS not only can provide research valuable to the people of the earth, but is also needed for NASA to reduce the risks associated with astronauts travelling for extended times beyond low Earth orbit.

Mr. Chairman, I would be happy to respond to any question you or the other Members of the Committee may have.

Chairman HALL. Thank you.
I recognize Admiral Dyer to present his testimony.

**STATEMENT OF VICE ADMIRAL JOSEPH W. DYER,
U.S. NAVY (RETIRED),
CHAIRMAN OF THE AEROSPACE SAFETY ADVISORY PANEL**

Admiral DYER. Thank you, Chairman Hall, distinguished members of the panel. Thank you for the opportunity to appear before you today.

As requested, I will present the ASAP's perspective regarding NASA's current acquisition approach for the Commercial Transportation System. As noted in our 2011 annual report, the Commercial Crew Program remains an important topic for the ASAP. We have closely followed the program and its progress and its acquisition strategy.

Sir, my outline for remarks today are how high should the bar be set with regard to safety, the certification contracts, a big step forward but how will they be administered, this relationship between the SAA and FAR contracts that Congressman Edwards addressed, and lastly, clear communications.

Congressman Hall, when I went through this with my wife last night, it took me seven minutes. She said that wasn't too bad for a Southerner. I told her you would understand.

In our 2011 report, we addressed the question, and I quote, "How safe is safe enough?" The pursuit of great reward often comes hand in hand with great risk so it has always been with explorers. The answer to the question must come from a balance between risk and reward and should reflect a consensus among the American people, the White House and the Congress. It is not our purpose or intent to answer the question, how safe is safe enough. It is instead to point out areas where we believe the stated requirement may not produce the requisite safety.

Mr. Gerstenmaier's team produced a retrospective review of the space shuttle safety program and risk with the benefit of 20/20 hindsight. During those genesis days, there was a belief that the risk of loss to crew was one in a thousand. Retrospectively, we believe now that it is one in 12. The design goal or design baseline for commercial space is one in 270 for a specific mission. So we raised the question, are we raising the bar high enough. That remains to be seen but I know it is very much on the mind of NASA.

In our submission, sir, we provide a checklist of what we believe are the six most important items, and as our practice, we have color-coded them red, yellow, green to reflect what we believe to be their status.

A solid green and a giant step forward is that NASA has clearly communicated to the partners-cum-contractors that certification is a fundamental requirement of transitioning NASA and transporting astronauts to and from space.

Three elements that we code as yellow, they are progressing. They are advanced significantly by the certification contracts but not yet in hand or establishing solid requirements, promulgating how the agency will verify those requirements and a validation and verification plan.

Two elements that are red in our mind deal primarily with the process that contractors shall follow on the path to certification. Congresswoman Edwards, as you indicated, it is not yet clear to us how waivers and deviations will be approved, who is accountable and how the process shall be administered.

Lastly, both from the Congress's perspective and NASA's perspective, budget and budget stability are a significant challenge.

Mr. Chairman, informally, Committee staff has asked, is the Space Act Agreement appropriate to support the development of commercial crew transportation capabilities. To date, many maintain that the freedom and flexibility of an SAA have enabled creativity and innovation, and it may be delivering greater value for money. That may be true. However, we arrive at this point in time with the designs that are maturing before requirements, where government and industry have not yet agreed on how winning designs will be accepted and certified.

The current acquisition approach and funded under the SAA construct is concurrent with a contracted or FAR-based certification program. It is unique and it is complex. In our opinion, this approach is a workaround for the requirements and the communication and challenges implicit in the SAA. It is not clear yet to the panel how the safety requirements necessary for certification will flow from the FAR contract to the SAA partners.

Let me speak specifically to communication, and I would submit this is my most important message of the morning. In our travels to Boeing, SpaceX, Orbital Sciences, Sierra Nevada and Blue Origin, we have heard pros and cons with regard to the SAA. Flexibility is universally the prime advantage. However, as the design matures and begins taking shape, partners seek reassurance that they are on the right track that will lead to successful certification. They posed specific questions about what NASA will eventually require of the designs but NASA interprets that they cannot provide the answers to these SAA questions, to these questions under the SAA construct. We ask the partners so in that case what do you do. One contractor answered by saying "We look for nonverbal communication, you know, body language and winks and nods." Mr. Chairman, if you are the congressionally chartered panel tasked to watch over safety, this is not a comfortable communication approach for requirements.

The FAR-based certification contract has the potential to overcome this challenge but it is a workaround for the downsides of Space Act Agreements. Thank you, sir.

[The prepared statement of Admiral Dyer follows:]

Statement of
VADM Joseph W. Dyer, USN (Retired)
Chairman
National Aeronautics and Space Administration's
Aerospace Safety Advisory Panel
before the
Committee on Science, Space, and Technology
Subcommittee on Space and Aeronautics
U.S. House of Representatives

Chairman Hall, Ranking Member Johnson and distinguished Members, thank you for the opportunity to appear before you today. As requested, I would like to present the NASA Aerospace Safety Advisory Panel's (ASAP's) perspective regarding NASA's current acquisition approach for the Commercial Transportation System (CTS).

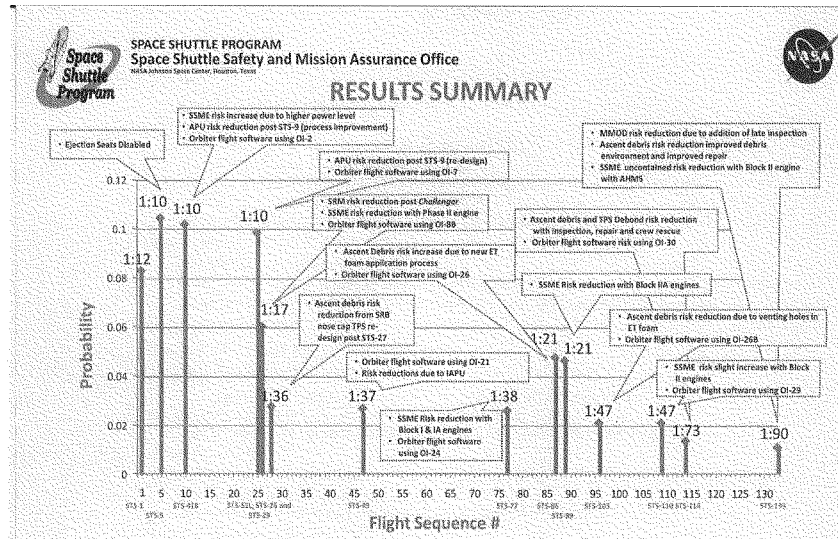
As noted in our 2011 Annual Report, the Commercial Crew Program (CCP) remains an important topic for the ASAP. We have been closely following the Program's progress and the acquisition strategy for the CTS.

The Panel is especially focused on requirements, design, and certification, given the historical reassessment of risk that was performed on the Space Shuttle. In that regard, I would like to quote from the ASAP's 2011 Annual Report:

"How safe is safe enough?" The pursuit of great reward often comes hand in hand with great risk—so it has always been with explorers. The answer to the question must come from a balance between risk and reward and should reflect a consensus among the American people, the White House, the Congress, and NASA.

It is not our intent or purpose to answer the question; however, we point to areas where we believe the stated requirement may not produce the requisite safety. We especially invite your attention to the section "Reassessment of Space Shuttle Risks" and the historical gap between anticipated and deployed systems risk.

[The results of the NASA analysis are depicted in the following graphic]



One key finding was that the risk on a new system that has not been flown before and thus has not been through the rigors of real-life flight is probably much higher than what the initial risk assessments show. The reason for this difference is that at the beginning of operations, all the failure mechanisms are not fully known. In the language of risk analysis, such unknown failure mechanisms are often called "unknown-unknowns." In the Shuttle's case, the first flight risk as now retrospectively calculated was in actuality 1 in 12 for LOC [loss of crew], yet at least one analysis that existed at the time of the initial launch estimated the risk to be 1 in 1,000 or better. In other words, the system was almost 100 times more dangerous than the early analysis indicated. This type of disparity must be remembered when future targets for reliability and LOC numbers are chosen for new programs. One thing that has always been said in the design business is that engineering design standards take care of the "knowns"; factors of safety take care of the "known-unknowns"; and margin is what takes care of the "unknown-unknowns." A significant margin for error should be allowed for the unknown-unknowns as well as to create a robust design.

NASA has determined that CTS certification contracts are needed for the International Space Station (ISS) mission. Quoting from a NASA white paper on **NASA Commercial Crew Program (CCP) Updated Acquisition Strategy, August 2012**:

“NASA has decided to begin initial certification efforts immediately to enable the earliest possible crew transportation. If NASA were to delay certification activities, the development of industry’s capabilities could eventually reach the point where any changes necessary to meet NASA requirements would likely not be technically feasible or affordable, potentially extending our reliance on foreign systems.

To mitigate these risks, NASA is moving forward immediately with CTS Certification activities, as depicted in Figure 1. By instituting critical, yet limited, early certification activities as soon as possible, NASA has the opportunity to minimize technical risks, and cost or schedule impacts that would result by waiting to begin CTS Certification activities after industry’s designs have been completed.”

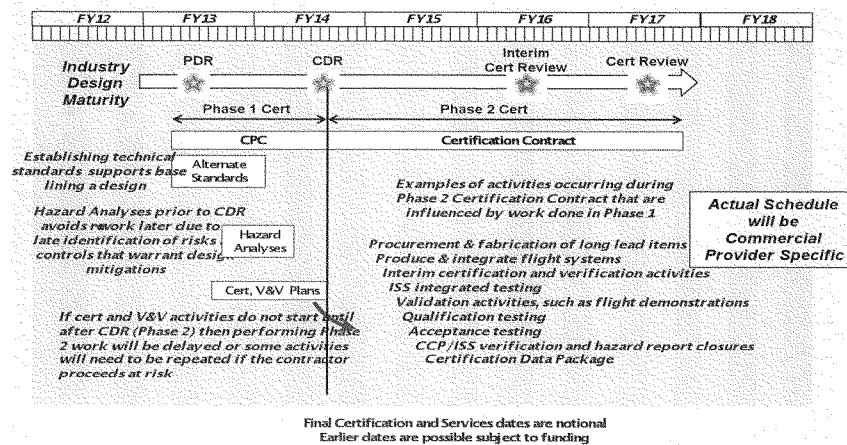


Figure 1: NASA's CTS Certification Activities

Continuing to quote from the NASA white paper:

“As depicted in Figure 2, NASA plans to award 2-4 FAR [Federal Acquisition Regulation]-based fixed-price contracts in CTS Certification Phase 1 to begin early certification activities. These contracts are referred to as Certification Products

Contract(s) (CPCs). The scope of the CPCs will be limited to submittal and technical disposition of the following specific, early lifecycle certification products: Alternate Standards, Hazard Analyses, a Certification Plan, and a Verification & Validation Plan. The CPC activities will not include any design, development, test or evaluation activities. The CPC period of performance will be approximately 15 months, with an expected award date in February 2013. CPC awards will not exceed \$10 million per award, and the total value of all CPC awards is expected to be \$30-40 million.”



Figure 2: Overall CCP Roadmap

At the conclusion of the CPCs, NASA anticipates that more than one commercial provider will have an integrated design with sufficient technical maturity to enable a Phase 2 competition for the CTS Certification Contract. The ASAP agrees.

NASA believes that having up to two contractors through Phase 2 would provide significant advantages for ensuring safe and affordable CTS through competition. The ultimate number of awards will be driven by technical maturity, funding availability, and mission needs. We agree that having two contractors through Phase 2 is advantageous. Lacking an independent cost estimate, we are uncertain as to affordability.

The ASAP offers a check list and provides our color-coded status assessment below. [A note on colors: **Red** highlights what the ASAP considers to be a long-standing concern or an issue that has not yet been adequately addressed by NASA. **Yellow** highlights an important ASAP concern or issue, but one that is currently being addressed by NASA. **Green** indicates a

positive aspect or a concern that is being adequately addressed by NASA but continues to be followed by the Panel.]

- a. • Clearly communicate to the contractors that NASA certification is a fundamental requirement prior to transporting NASA and NASA sponsored astronauts into space.
- b. ♦ Establish solid requirements – (Improving with the advent of the Certification Product Contract and Certification Contract)
- c. ♦ Promulgate how the Agency will verify that requirements are being met – (Improving as in b., above)
- d. ♦ Possess a validation plan that confirms the required capability – (The plan is late, but will be produced in the upcoming CPC contract)
- e. □ Clearly lay out a process that the contractors shall follow on the path to certification – (It is not yet clear how waivers and deviations will be approved, who is accountable, and how the process shall be administered)
- f. □ Stabilize NASA's budget at a level sufficient to execute the plan – (Made more difficult by the lack of a good cost estimate and a stable acquisition plan)

Mr. Chairman, in your invitation letter of September 7, 2012, you asked that I relay the ASAP's assessment on NASA's current acquisition approach. We believe that the Phase 1 and Phase 2 approach to clear the certification "fog" is a significant step forward. We believe, and NASA concurs, that both Phase 1 and Phase 2 must be FAR-based contracts. The Panel believes a fixed price contracting approach is satisfactory for Phase 1, where establishing technical standards is the objective. NASA has not yet decided upon contract type for Phase 2, which encompasses interim certification, verification, and validation.

The ASAP strongly believes that only a cost type contract is appropriate for Phase 2. We believe that fixed price type contracts are appropriate for low risk undertakings where the requirements are clearly understood by both the government and the contractor(s). Phase 2 is neither, and we believe both schedule and safety would be enhanced in a cost-plus environment. Why? While Space Act Agreements (SAAs) may have stimulated new companies to enter the business, much remains unsettled. Design has preceded requirements, and with the recent phased approach, NASA is just now undertaking to determine how systems will be certified to transport NASA astronauts to and from the ISS. This timing increases programmatic risk and has serious potential to impact safety.

Additionally, any number of Department of Defense (DOD) programs provides evidence that the presumed cost advantages of fixed price development may be illusory. The following picture perhaps best illustrates the result of trying to manage fixed price development.



Mr. Chairman, informally, the committee staff has asked, “Is a Space Act Agreement appropriate to support the development of commercial crew transportation capabilities?” To date, many maintain that the freedom and flexibility of an SAA have enabled creativity and innovative design solutions and may have delivered greater value for money. That may be true. However, we arrive at this point in time with designs that are maturing before requirements, and where government and industry have not yet agreed on how winning designs will be accepted and certified. We worry that the cart is ahead of the horse.

The current acquisition approach—CTS Development that is funded under an SAA concurrent with Certification that is funded under a FAR-based contract—is complex and unique. In our opinion, this approach is a workaround for the requirements and communications challenges implicit to the SAA. It is not yet clear to the Panel how the safety requirements necessary for certification will flow from the FAR contract to the SAA “partners.”

Let me speak specifically to the communications challenges under SAAs. In our travels to Boeing, SpaceX, Orbital Sciences, Sierra Nevada, and Blue Origin, we heard pros and cons about SAAs. Flexibility is universally the prime advantage; however, as design matures and begins taking shape, the partners seek reassurance that they are on a track that will lead to successful certification. They pose specific questions about what NASA will eventually require of the designs, but NASA cannot provide those answers under the SAA construct. We asked, “In

that case, what do you do?" One contractor answered by saying, "We look for nonverbal communication...you know, body language and 'winks and nods'." If you are the Congressionally-chartered Panel tasked to watch over safety, this is not a comfortable communication approach for requirements. The FAR-based certification contract has the potential to overcome this challenge, but it is a workaround for the SAA's downside.

In summary, in the Panel's view, NASA is being very creative and doing all it can to develop a commercial crew transportation capability on a very limited and potentially unstable budget. However, they unquestionably face a number of challenges in reaching the point where these systems can be confidently certified as being "safe enough" for the astronauts that rely on this process to ensure their safety.

Chairman HALL. Admiral, thank you. It was a very good presentation. You kind of shook your finger in our face there once. Did you do that to your wife?

Admiral DYER. She usually does it to me.

Chairman HALL. Good testimony, and we thank you for it.

Don't judge the interest of this Committee by empty chairs here because November 7th or 6th is coming pretty soon, and we have just a few working days. Each of them has somewhere to go. I am not unlike each of them because I have to leave the chair to go to the Floor for a while and I am going to ask the Chairman of Space and Aeronautics, the gentleman from Mississippi, Mr. Palazzo, to take the chair until I get back, and not to get used to it or don't enjoy it too much.

Mr. PALAZZO. [Presiding] I want to echo Chairman Hall's comments, and thank you again for your solid testimony. I would also like to remind Members of the Committee, rules limit questioning to five minutes. The Chair will at this point open the round of questions. The Chair recognizes himself for five minutes.

Admiral Dyer, this is going to be directed to you. Many of us on this Committee lived through the aftermath of the Columbia accident investigation and remember some of those lessons. NASA needs clear requirements and good communication with its companies. Your testimony points out how NASA's planned approach, where development is funded by SAA concurrent STET with certification funded by FAR-based contract is complex, unique, and a workaround for the communications and requirements that are necessary to ensure safety and NASA's final certification. If your panel is not comfortable with this approach, then Congress should not be comfortable either. What is the worst-case scenario from this process and what keeps the ASAP up at night?

Admiral DYER. Well, sir, there are a number of things that keep us at night, and let me address two uber ones and then I will home in a little closer. The first worry is frankly that another administration takes another approach to space program, as we have seen over the last several Administrations in our country. If that happens, it is going to be a long way to Mars. Closer to home, this issue of clarity and focus is important, we believe, from the ASAP perspective. There are different leadership perspectives within NASA, and frankly, there is some lack of clarity that makes the program harder to manage, that along with the cost estimate that Congressman Edwards mentions.

The agency knows how to build space systems. The agency knows how to support economic development. But the concurrency and some uncertainty as to which is prime is making the program harder to manage. Likewise, the budget lack of a cost estimate on behalf of NASA and the uncertainty and instability as funding finds its way to NASA are probably the largest worries. To get to the bottom perhaps of the question you are asking, were NASA to run short of funds and in an attempt to deliver with lesser funds if they were to continue with the Space Act Agreement and put aside the FAR-based contracts, we think that would not lead to a good place.

Mr. PALAZZO. Admiral Dyer, proponents of NASA's commercial crew acquisition approach often tout the monetary contributions of the companies as an example of efficiency in government con-

tracting, the implication being that the company should have some skin in the game. Yet as a business leader, I am sure you understand that companies only lay out money if they believe they can get it back plus an adequate return on their investment. Would you comment on how the life cycle costs of NASA's current approach could lead to higher seat prices to the government than if standard contracting had been used in the beginning?

Admiral DYER. Well, I am an engineer like my friend, Bill Gerstenmaier, so let me use the technique of let us look at it in the limits and then decide where we are somewhere in between. On one end of the continuum, if a company pays the total bill in and of themselves, then they should have total freedom and the marketplace should determine the utility but the buyer in this relationship has only an indirect influence on what the company designs and delivers if they are doing it all themselves. Over on the other end of the continuum in a more classic government, fully government-funded undertaking, the government has great influence as the buyer. They can specify what they want and what the system should deliver. We are on neither one of those continuums. We are somewhere in the middle with a significant amount of money being paid by the government, a smaller amount of money being "skin in the game," as you call it, but the influence in some people's mind is the inversion of that. Even though there is a small amount of contractor money in the game, there is tremendous influence via an SAA.

So let us just for argument's sake say that we are totally in the middle and everybody is paying 50/50. Does that represent a good lifecycle cost equation? Well, it does if it succeeds but it doesn't if it fails.

Mr. PALAZZO. Mr. Gerstenmaier, would you like to respond?

Mr. GERSTENMAIER. Yes, I would say that I think the advantage here to the contractors is, they see a market out there for these vehicles and this capability beyond NASA's needs so they look at what they are doing with their rocket development and it can be used for other applications and it can fly in other areas separate than NASA, so they have a market beyond us so they are willing to put some development funding into this activity so they can support that other activity when it comes about with their capability they are developing, and that will essentially lower the cost for us in development.

So what we are doing is, we are essentially allowing them to take the work that they are doing, the development they are working on for the launcher, for example. In the case of SpaceX, that launcher can be used to launch satellites in another market separate from NASA. That helps them expend or receive revenue in those other areas, so that is the reason that they are contributing. Boeing looks at it. They see another market out there for commercial crew flights to space and so does Sierra Nevada as well. So they see another market out there so they are building this capability not only for NASA but for their own use, so therefore it is appropriate for them to contribute some portion of the developmental costs to this activity.

Mr. PALAZZO. Thank you.

I now recognize Ms. Edwards for five minutes.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you, gentlemen. I don't know if others heard it, but I have to tell you, Admiral Dyer, I hear real warning signs coming out of your testimony and particularly when you talk about proceeding with designs before you have requirements. I just don't get that.

Mr. Gerstenmaier, does the schedule that you outlined in your acquisition strategy assume that you will receive the President's budget request level of \$830 million per year for the remainder of the development program?

Mr. GERSTENMAIER. Based on our BPD submit in 2013, it does from 2014 on. We expect to receive that level of funding.

Ms. EDWARDS. Do you think that level of funding really appears likely in the current fiscal environment, and what would be the impact on your schedule if you get an annual funding level of \$500 million per year?

Mr. GERSTENMAIER. Again, where we are for 2013 is, we are uncertain about the funding level in 2013 because we are sitting here with a Continuing Resolution so we are held back basically at the funding level of 2012. We have accommodated for that funding scenario in 2013 here where we have been hoping in 2013 we would get somewhere around the Senate level that has been discussed in some of the bills. We will see what we get. Then from 2014 on out, we are looking at getting in the 800 level of funding, and as part of the PB14, we will provide you the details of the cost estimate, the details of the budgeting that go behind that in an effort to try to get support for this program that we think is critically important and we need on the order of the \$800 per year in 2014.

Ms. EDWARDS. I strongly suggest that, especially in this environment here, to pen an estimate of completion and activity based on a hope is a real challenge, I think, for the agency.

Admiral Dyer, does NASA's commercial crew budget seem sufficient to you and what are your considerations as you answer that question?

Admiral DYER. NASA of course supports the President's budget but I will tell you from close and long-term association with the folks at NASA, they feel they are underfunded. They feel they are challenged to deliver what they are asked to accomplish with the funding available. They are being innovative, and that is good, but I recommended, Mr. Chairman, in my first appearance before this Committee some years ago that if I could give NASA and the Congress a single gift, it would be a good cost estimate.

Ms. EDWARDS. Can I just ask you then, given that statement, how is it that in the absence of an independent cost and schedule estimate can we in Congress know with any level of confidence what it will get for whatever budget NASA proposes?

Admiral DYER. Well, that is a challenge. It is an understanding of what it is going to cost to deliver, number one. Number two, it is a confident place to stand with the best of conscience because somewhere along the line of fewer dollars, longer time, less money, there must be a place where good conscience says we can't deliver for this. Now, I will tell you right up front, I have 30 years of association with Charlie Bolden and the very highest respect for Bill Gerstenmaier. These folks will not violate good conscience but we are making it hard for them.

Ms. EDWARDS. Thank you.

And just as I close, Mr. Gerstenmaier, can you just tell me why you failed to seek an independent cost assessment and a schedule for the Commercial Crew Program and isn't it the norm for all the other NASA major programs to do such?

Mr. GERSTENMAIER. We have the basis for our cost estimate which we have provided to you. It is not a traditional cost estimate. If you look at what we are doing here, we are procuring under a hybrid discussion, as we talked about the Space Act portion and the contract piece. We ask the contractors as part of the commercial crew integration capabilities Space Act to give us the cost to go all the way to a demonstration flight. We now have that cost data available from those proposals. We are going to take that cost data now and run it through an independent group to take a look at that and develop an independent cost estimate based on that data we received from them and will provide that to you as part of the President's budget request for 2014. So we will give you the data associated with what we have got from the contractors or from the Space Act activities and we will provide that to you as an independent assessment as we go forward in 2014. And to be frank, that was as fast as we could get it to you with this hybrid approach that we were taking.

Ms. EDWARDS. Thank you, and I yield.

Mr. PALAZZO. I now recognize Mr. Smith from Texas for five minutes.

Mr. SMITH. Thank you, Mr. Chairman.

Mr. Gerstenmaier, you have a wonderful reputation for your technical knowledge and for being a good manager, so I would like to direct some questions to you. The first one is that I appreciate the funding constraints that have been mentioned, but has the White House sent any signals to you to go slow either on Orion or SLS?

Mr. GERSTENMAIER. No, we have received no signals to go slow on either Orion or SLS.

Mr. SMITH. Okay. Next question is, when it comes to NASA and the target deadline of 2014 for the first test launch of Orion, what are the odds that NASA will make that 2014 deadline?

Mr. GERSTENMAIER. We have very solid plans to have the Orion capsule ready to support that 2014 test flight. Our plans now show delivery of that vehicle. It is actually in Florida undergoing outfitting in Florida. It should be complete and ready to be turned over to the launch vehicle at the end of next year, in December of 2013. What we are waiting on is the launch vehicle. The current launch vehicle availability is September of 2014, and so pending the launch vehicle, I believe we will be ready to fly in 2014. But the capsule work is going very well. We are working heat-shield problems. We are working some avionics problems. We are working some parts problems. That is all normal stuff we do normally. We have got schedule margin. We will have the vehicle ready to go fly at the end of 2013. All we need is a launch vehicle.

Mr. SMITH. A hundred percent sure?

Mr. GERSTENMAIER. I am never a hundred percent sure but we will be ready before the launch vehicle is ready. That I can tell you.

Mr. SMITH. Great. Another odds question. What are the odds that Boeing and SpaceX and Sierra Nevada will meet their scheduled deadlines?

Mr. GERSTENMAIER. If you take a look at some of their proposals or you discuss with them, they show earlier crew transportation dates than 2017. They think they can be earlier than those dates. From a NASA perspective, we backed off. We said it wasn't appropriate to accept their dates. We wanted some margin in that. So we have done our planning based on a 2017 delivery date, which gives us some margin.

Mr. SMITH. So you have every expectation they will meet their deadlines?

Mr. GERSTENMAIER. I think they will be a little bit late from what they are advertising in their proposals but they will be there about the time we estimate in 2017.

Mr. SMITH. Okay. Thank you for that.

My last question is this. There has been some discussion about the definition of "commercial" as it is applied to commercial crew and cargo programs. What percentage of the funding for those programs comes from the private sector and what percentage of the funding comes from NASA?

Mr. GERSTENMAIER. It varies by each one of the participants in the Space Act the amount, and it is proprietary to the companies the exact percentage, but there is a contribution by them. It is smaller in some cases and larger in other cases.

Mr. SMITH. Overall, it has been my understanding that 80 or 90 percent of the funding comes from NASA. Is that a ballpark legitimate figure?

Mr. GERSTENMAIER. I would say the majority of the funding is coming from NASA for this activity.

Mr. SMITH. Does that raise any questions about applying the term "commercial" to some of these enterprises or are you comfortable with that application?

Mr. GERSTENMAIER. We could have a long discussion about what the term "commercial" really means. The way I look at it is, I would not use that term specifically but what we are doing is, we are getting a contribution from the contractors to help in this activity because they believe there is another market out there. If you want to pin the term "commercial" on that, you can pin the term but the facts are what I described.

Mr. SMITH. And regardless, we appreciate what they are doing and their capability as well. Thank you, Mr. Gerstenmaier.

Thank you, Mr. Chairman.

Mr. PALAZZO. I now recognize Ms. Bonamici from Oregon for five minutes.

Ms. BONAMICI. Thank you, Mr. Chair. Thank you both for your testimony and for all you do.

Admiral Dyer, I want to follow up on the issue of how the role of Aerospace Safety Advisory Panel is shaped based on the underlying purpose of the commercial crew initiative, and I know in the past ASAP has written about the need for clarity and consistency of purpose, and you talked about that in your testimony. So in ASAP's opinion, is the purpose of the Commercial Crew Program

to develop the commercial space industry or is to acquire transportation to the International Space Station?

Admiral DYER. Well, that is a great question and one that we have asked and one that is not entirely clear in its answer, at least to us. Is it economic development, looking back to the 1930s and the role that government played in what became our aviation industry via the airmail programs or is it transportation of astronauts to the International Space Station and to low-Earth orbit. De facto, I think the answer is both, that NASA is attempting to do both. But part of what we mean by a lack of clarity is an answer to which is the priority and which is first function and first focus. Sometimes I think the administration and leadership of the program is harder because those priorities seem at least to ebb and flow.

Ms. BONAMICI. Thank you. Thank you very much.

And I wanted to ask Mr. Gerstenmaier, the work that NASA does is very important to everyone in the country, but in the district I represent in Oregon, it is home to a lot of high-tech companies in an area known as the Silicon Forest, and though they may be not directly NASA related, the technology companies in the district certainly all benefit from the development of new, innovative solutions that NASA has been responsible for over the years. So I want to ask about the development of a domestic alternative to the Russian Soyuz spacecraft that is currently being used to transport crew members to the ISS, and apparently you have indicated earlier this year, I believe in Senate testimony, that the domestic alternative is expected to reduce costs, and I understand it may be too early to determine the exact value of that cost reduction and those savings but will you please discuss what factors you will be considering in making the eventual determination and discuss particularly how or whether NASA will consider the intangible benefits that a domestic alternative may have, especially in the area of innovation and economic development. It is a balance, and I wonder if you could suggest how we can use this acquisition policy to simultaneously encourage private-sector creativity and innovation but without diminishing the safety of our astronauts. Thank you.

Mr. GERSTENMAIER. You articulated very clearly all the things we are trading back and forth. We clearly have to keep safety as number one in this activity and make sure we have a transportation system that can keep our crew safe, and Admiral Dyer described pretty clearly what one of the big questions is how safe is safe enough, and we are going to have to work collectively to determine that. None of us can do that individually but we will definitely adhere to safety.

Innovation is very important. Doing things domestically is also important, to challenge our folks to do things a new way, to look at using commercial products to look at other ways of getting crew to space has tremendous advantages to us domestically here in the United States. We also would like to get good value. We budgeted at roughly the Soyuz seat price in the outyears with inflation going forward. We would like to get lower than that and we will see where the costs come in as we go through this activity and we get better understanding of where things move but I think the things you describe are things that we need to trade across each other.

The one that I think that becomes a line around is safety. At some point we don't trade beyond that. We need to make sure we get a capability that will support what we need. Then the next piece comes in, the cost side. If the costs go extremely high, which we don't think they will, we think we have a good chance to get the costs less than Soyuz but if they go high then we need to trade, are we getting significant benefit on the innovation side and the domestic production side to make that warranted, so we will articulate to you to the best of our ability where we see that information fall out and with you we can help make those trades that are right for the Nation.

Ms. BONAMICI. Thank you very much. I yield back. Thank you, Mr. Chair.

Mr. PALAZZO. I now recognize Mr. Rohrabacher from California for five minutes.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

I am trying to get a feel for what is really going on here, and first let me ask, this hybrid system that you are talking about obviously this is not a pure commercial system that we are working on. Obviously we are heading in that direction. Perhaps that is why that term is being used. That system was put in place and it has been utilized this one time for the supply of the space station. How much did that save us or did that cost us to utilize that new system rather than the traditional ways that NASA has been using to resupply the space station?

Mr. GERSTENMAIER. In the case of cargo, I can't give you a specific number of what we saved, but if you look at the launch costs and the cargo delivery, it is substantially less by using the Space Act approach than actually acquiring the services under a FAR part 12 contract for the actual delivery of the services. So that has been a significant savings to us.

The thing that we need to consider with crew is, there is another dimension and that is the safety aspect, and we need to watch that as it goes forward, but there was a significant savings by using this approach with cargo.

Mr. ROHRABACHER. Right, and a significant savings, and did you identify that there was a significant greater risk of using this hybrid system?

Mr. GERSTENMAIER. I think that the risk in the case of cargo was schedule. We got the systems delivered to us later than we would have desired but we were able to extend the shuttle with an extra flight that made that risk tolerable to have that schedule delay acceptable to us overall.

Mr. ROHRABACHER. There is a lot of concern being expressed today about extending a system that has already worked for cargo and trying to utilize that for crew, and it has already proven very significantly successful in terms of financially without really identifiable risk except of the schedule, and now people are very concerned that we might apply that same hybrid principle to crew. Now, obviously we are concerned about the lives of the crew. Let me also—so that is just one fundamental that I see going on here in this hearing.

And Admiral, you said something in passing that sort of started me thinking. It is a long way to Mars basically unless we have this

steady—if we can't count on steady funding. Let me suggest that I think that nobody wants to face the fact that we can't afford to go to Mars now. The bottom line is, in order to have steady funding, we are going to have to defund every other space project that we have. Nobody wants to face that. Maybe if we are going to provide safety, maybe if we are going to provide reliability and do this professionally, maybe we should set our goals to something that we can actually accomplish within the budgets that are possible without destroying every other aspect of the space program. I think that is what is happening here today. That is what we are really discussing. And I think there is a lot of things that we can do in space. I think that this hybrid system that we are talking about now will give way to really a commercial industry in which we can have people perhaps putting—we have an example of that from the gentleman in Nevada right now who is building space systems that they can put up there and inflate, and they have already actually put one up into space where you have a space habitat not done by the government, and it just seems to me that if we are going to be the number one space power, we have got to have responsible goals in mind.

I went to Neil Armstrong's funeral ceremony yesterday, and of course, I am of the generation that he was the ultimate hero of our generation, and I think he will be the ultimate hero of a thousand years of human history quite frankly, but that Apollo program, it appears to me that some people want our entire space program to be based on the structure of Apollo. They want—and we did that for the moon. I don't think we can do that for the entire—and expect to accomplish the great other things that we have to accomplish. We can't do that for Mars at the expense of what it would take and expect to have any other kind of space program. We have some very serious issues that we need to discuss in terms of safety as we move forward in terms of the way we approach things.

I appreciate both of you today giving us a lot of insights as to where we are at and how to proceed, so thank you very much.

Mr. PALAZZO. I now recognize Mr. Clarke from Michigan for five minutes.

Mr. CLARKE. Thank you, Mr. Chair.

This question is for both of you gentlemen, and it deals with the differences between acquisitions through the FAR and the Space Act Agreements. Specifically, in your opinion, how would the outcome of the award and the evaluation of this contract for transportation services be different under the FAR as compared to granting the money through Space Act Agreements? How would the outcome of the award and evaluation process be different?

Admiral DYER. I will go first and quick and tell you that the panel doesn't have access or knowledge with regard to source selection so I am afraid I am no help with that one, sir.

Mr. GERSTENMAIER. I would say that the differences at the top level are with the Space Act, NASA loses the ability to direct the contractor exactly how the requirements are done. As Congressman Edwards talked about, we can see what is happening in the design but we cannot directly influence the design so we get a lot of insight into what is happening. We can see how they are designing the vehicle. We can see how they are putting it together—Admiral

Dyer talked about that—but we cannot give them positive feedback, is that design good or is that design not good. We can just listen to the design and be there. In a contract, we have the direct ability to interact with the contractor and tell them exactly what we want, the way we want it and ensure that it meets our requirements. What we are doing with this hybrid approach is we are letting them have this freedom to go ahead and design but then we are holding it almost in parallel as fast as I can. In February of 2013 we will have a contract in place where we can then have them tell us whether they want to use alternate standards, they don't want to build it the way we want to. We can provide direct feedback to them under this contract. We are going to ask them how they do hazard reports, how they control the risks associated with spaceflight. We can provide direct feedback to them. So what we are trying to do is, we are trying to take the advantages of a Space Act that allows them to run fast and quick but then we are in parallel going to put on top of that a mechanism that we can get some ability to interact with them in a more formal manner to actually control the design, that we get something that comes out the other side that we can actually use. So those are kind of the advantages and disadvantages. If you did a pure contract, we would be much more involved and it would be probably a little bit longer process and a much more costly process if we did just a pure contract.

Admiral DYER. Congressman Clarke, just to shirrtail on Mr. Gerstenmaier's comments, NASA is the keeper of our body of knowledge on how to get systems into space. So to have better and clearer communications, to overcome that problem that Bill just voiced is the thing that we think would be most important as we go forward in any construct in any type contract.

Mr. CLARKE. Thank you, gentlemen. I yield back my time.

Mr. PALAZZO. I now recognize Mr. Bartlett from Maryland for five minutes.

Mr. BARTLETT. Thank you both very much for your testimony and your service.

I understand that it is now generally conceded that transportation via this new vehicle could cost several times as much as going on the Soyuz. Is that correct?

Mr. GERSTENMAIER. We don't believe that that is the case. We have done some kind of worst-case analysis, I would say, to go ahead and bound the upper limit of the budget, and that is what you may be referring to where we have some cost estimates where the seat price is higher than the Soyuz, but then when we look at what we have got in CCiCap proposals, we look at what we have done under this new method and we can see various approaches that get us below essentially what we believe the Soyuz seat price is. So I think we have seen both. We will continue to go work those and see where we are, so we see a range of prices.

Mr. BARTLETT. Obviously from a national-pride perspective, we would rather be riding our own horse. Was there any discussion up front as to how much we might be willing to pay in excess cost to make this happen?

Mr. GERSTENMAIER. We have not had that discussion in terms of excess cost. I believe that is still in front of us as we bring this design a little bit more to maturity.

I think the other piece is, it is not just having our own horse but I talked about it in my oral a little bit, to have another way to get to space station with our crews other than just the Russians is tremendously important. You know, even when we had the Columbia tragedy, we could not have kept crews onboard space station. We could have not continued to assemble space station without the Russians being able to back us up with transportation. So no matter how good a transportation system is, for an asset that is critical as the space station is to get research done and continue to moving forward, we believe we need an alternate way to get to space station, and that is what we are doing with our crews and that is what we are doing here with this activity, this commercial crew transportation activity.

Mr. BARTLETT. I understand our goal for this new asset in terms of safety is one in 273. Can you tell me what that is for the Soyuz?

Mr. GERSTENMAIER. We don't have an exact number associated with Soyuz. We have looked at it from a historical standpoint. We don't have a detailed understanding of the systems design and the hardware designs but we looked at it and we would say the Soyuz is equivalent to that but I can't provide to you a detailed analysis that shows exactly that equivalency, but if you look at the flight history of the vehicle, the amount of time they have flown, I would say that in a more qualitative discussion, you can say they are roughly equivalent.

Mr. BARTLETT. I really hate to ask this next question because I am a scientist and a huge supporter of NASA and human spaceflight. If the sequester occurs, it would cut defense about \$50 billion next year. Defense is about one-fifth of our spending. So let us be fair and cut everything a commensurate amount. That would mean \$250 billion next year. That means we are cutting Medicaid, Medicare, Social Security. These cuts are considered draconian and impossible but if they occur, the full \$250 billion, that would be somewhere between only one-fourth and one-fifth of our deficit. Now, if we cannot possibly cut one-fourth to one-fifth of our deficit, how do we ever get there? I have 10 kids and 18 grandkids and two great-grandkids. Obviously it is not going to be business as usual. Obviously we can't continue doing the same things that we are doing now, and there is going to have to be a line that we draw: above that we fund; below that we can't fund. How do we determine where we put this program, above or below that line?

Mr. GERSTENMAIER. No, I am not sure I can even answer that question. We can talk about our programs. We can talk about the value of the programs but then it is ultimately up to this body and a larger body to decide what the right answer is to that question.

Mr. BARTLETT. Admiral?

Admiral DYER. I really don't have anything to add to Bill's last comment, sir.

Mr. BARTLETT. Thank you very much. I yield back.

Chairman HALL. The Chair recognizes Mr. McNerney, the gentleman from California.

Mr. MCNERNEY. Thank you, Mr. Chairman. I am glad to see you back here this morning again.

Mr. Gerstenmaier, let us talk about the Commercial Crew Program for a little while. Now, is the plan—I understand what you

said earlier that we are not going to completely eliminate looking at the Soyuz as a backup program but does this eliminate the use of the Soyuz as our main reliable carrier for all of our crews or are we going to still rely on the Soyuz every so often for our transportation?

Mr. GERSTENMAIER. Our intent would be to use this U.S. space carrier for all the transportation to and from ISS.

Mr. MCNERNEY. Thank you. That is good.

Admiral, do you think that the Commercial Crew Program is receiving more or less scrutiny than the oversight NASA would receive if there were no private-sector involvement? Do you think there is more or less scrutiny now?

Admiral DYER. The essence of the Space Act construct limits the flow of information and prohibits direction from NASA into the partners. They are not contractors. "Partners" is the operative word. So I think an honest answer to your question is that there must be less because this large body of knowledge that NASA holds is more difficult in its transfer to those that are building the future space systems.

Mr. MCNERNEY. That isn't the answer I expected. Does that put us at more risk then in terms of safety for our astronauts?

Admiral DYER. You know, sir, you can build confidence in systems that fly in a couple of ways. The first way I will mention is difficult, expensive and long in coming, and that is that you just fly it enough or launch it enough to where statistically you have built the confidence that it is good to go. That is not a launch or two or three or even ten, but if you launch enough, you can build confidence that it is solid and it is ready to go. And frankly, I think that is part of our confidence in the Soyuz system.

On the other end of the continuum, you can have detailed knowledge of the design, detailed insight into the build, and intimate knowledge in the truthfulness of the people. That comes with the intimacy that in our opinion is difficult to establish in the Space Act Agreement.

Mr. MCNERNEY. Thank you. I appreciated your earlier comment, Admiral, that your biggest gift would be an accurate budget assessment. What do you think the most difficult part of the budget is? Is there a specific item or is it just too many uncertainties all up and down the chain?

Admiral DYER. Mr. Gerstenmaier, I think, spoke to it when he said this is a different animal. We know how to do a classic contract, classic FAR-based government procurement. This isn't one of those for many and perhaps many good reasons. So it is more difficult but I don't think it is impossible. I will speak with a little more freedom than I did in my DOD days when I was sitting in testimony on the Hill and tell you that one of the things that I like about a solid cost estimate is it gave me a confident place to stand if it was cogent. They are never right, by the way. They always evolve. But if it gives you a cogent place to stand, then I could be supportive and defensive of the budget that I thought it would take to execute. And then if that budget was cut, other folks wore some of the responsibility for reducing the funding to that program, be it extended schedule, be it increased risk, be it what have you. But others had to wear some of the responsibility. If you don't have a

cogent cost estimate, you don't have a place to stand for that conversation.

Mr. MCNERNEY. Thank you for your frank answer, Admiral.

Mr. Chairman, I yield back.

Chairman HALL. All right. The gentleman yields back. The Chair now recognizes Mr. Brooks, the gentleman from Alabama, five minutes.

Mr. BROOKS. Thank you, Mr. Chairman, and Mr. Gerstenmaier and Admiral Dyer, thank you for your service.

I would like to get into the finances a little bit more. It is something you all have touched on. And if you could, share with me what is each Commercial Crew Integrated Capabilities participant's total private investment, or, in a different way of approaching it, the percentage of the government commercial crew award versus the private investment in these programs.

Mr. GERSTENMAIER. Again, I can't provide the specifics because it is proprietary to the companies but it is on the order of probably 80 percent, 90 percent as we have discussed government investment. It could be a little soft around those numbers but it is on that order overall, and it varies from partner to partner in the Space Act activity.

Mr. BROOKS. Is it fair to say then that the private-sector contribution to the total cost is in the neighborhood of 10 to 20 percent, the inverse of 80 to 90 percent? What is your degree of confidence that the private sector is contributing somewhere between 10 and 20 percent, not more, not less?

Mr. GERSTENMAIER. I think we have pretty good insight into what is going on, and we believe that they are contributing on that order. There is no reason to doubt that they are actually contributing those portions that we have discussed.

Mr. BROOKS. Do you have any data that establishes the amount, perhaps that you can't share with us today because it is proprietary?

Mr. GERSTENMAIER. I don't have any direct data. You know, you would typically ask me, do I have a 533, do I have an accounting sheet, a record formally transmitted from, and I do not have that, but we see it from evidence of work they are doing, activities they are doing and other things, so we indirectly can attest to the numbers that I just talked about.

Mr. BROOKS. Thank you. And continuing, Mr. Gerstenmaier, at a rate of no more than two NASA missions per year, most analysts conclude that only one provider will ultimately be needed. If only one provider is selected to provide this service, how much government funding will have been provided to the other firms that will not be providing subsequent services to the United States government?

Mr. GERSTENMAIER. If you want a precise number, I can take it for the record and we can go calculate what that number is, but there will be funds that will have gone to these other providers that are not providing a service. The question is, is the market going to be just ISS or is the market going to be bigger than ISS. What we hear from these commercial companies is they believe that there is a market for their spacecraft that is beyond the government's need. They believe there is a commercial-sector market

for that. So even though one of these companies may only provide services to NASA for our ISS activities, the others may have another market to go do that can be there. Then I have the advantage from the government side is now I have another contractor that I could go back and pick up to go provide services later in some future activity if we decide to extend, for example, space station beyond 2020 and we need some additional services. It may be someone else in the market for us to go by. So we are investing in that other contractor as you described but we potentially get some benefit if they can generate a market on their own.

Mr. BROOKS. That underlying premise in the question was that there would only ultimately be one provider needed to do the two-plus or minus NASA missions a year. Is that an accurate premise?

Mr. GERSTENMAIER. I believe that is where we are looking for the actual services flight we are looking at potentially we say likely one provider in that region. I think the other reason we want to carry multiple providers earlier is, it provides a competition across those providers which keeps them meeting NASA requirements, it keeps them wanting to invest their own funding in this activity so that avenue of competition up front also gives us some pretty strong benefits to help us get a good price coming out the end, even though we may ultimately down-select to just one contractor or one—yeah, one contractor.

Mr. BROOKS. In the Committee notes for this hearing, it states, “On August 3, 2012, NASA ordered Space Act Agreements to three different companies with a combined value of \$1.113 billion. Boeing will receive \$460 million, SpaceX will receive \$440 million and Sierra Nevada will receive \$212 million.” Is that consistent with your recollection?

Mr. GERSTENMAIER. Yes, sir.

Mr. BROOKS. And if I do the math correctly, if only one of these three companies is ultimately going to be providing services to the United States government, if, for example, that happens to be Boeing just because they are the ones that are receiving the most money, that means roughly \$650 million would have been spent on companies for which NASA is not getting any direct service but we are spending the money on the hope that some day that competition will lower the cost. Is that a fair assessment?

Mr. GERSTENMAIER. I would add that the benefit of having competition, it is very difficult at this stage in the development to pick a winner. If I knew with certainty which one of those companies could actually come through this process and deliver a product out the other side, I could pick now. But at this point in where we are, I want them to continue their development. I want them to get into tests. I want to see how their hardware flies. I want to understand whether they have a safe system or not. And that, I guess the extra cost you describe, I believe that gives us significant benefit that it gives me an opportunity to select another provider if I see one system is safer than another. It gives me an option to move forward. So even though there is an extra cost, I believe there is a significant benefit to us, not monetarily but from a capability standpoint and from a safety standpoint of carrying multiple providers at this phase.

Mr. BROOKS. Thank you, Mr. Gerstenmaier, for sharing your insight on why we are doing what we are doing.

Mr. Chairman, thank you for the additional minute.

Chairman HALL. Thank you, sir.

I will recognize Mr. Hultgren of Illinois for five minutes.

Mr. HULTGREN. Thank you, Mr. Chairman.

Mr. Gerstenmaier, NASA's acquisition plan includes a costly phase, and I think it is about \$4.5 billion of optional milestones. I wondered, would these optional milestones if selected; using Space Act Agreements or Federal Acquisition Regulations, so SAA or FAR?

Mr. GERSTENMAIER. They are only available for us to exercise under the Space Act and they are only—and we have the ability to exercise them one at a time. So we don't need to pick up the entire phase. We could do those one at a time but they would be under a Space Act.

Mr. HULTGREN. Do you know, do the companies expect the optional milestones are part of the certification path?

Mr. GERSTENMAIER. I think you would have to ask the companies. I don't anticipate using those in the certification activity. We believe we are going to move to this certification products contract phase one followed by a phase two as shown in the white paper. We may choose to implement one or two of those milestones but we will be careful about which ones of those we choose and we will make sure they are justified and understood and they provide significant value back to the U.S. government.

Mr. HULTGREN. So your expectation from NASA's point of view is that they wouldn't be used, or if they are used, there would be very minimal usage. Is that right?

Mr. GERSTENMAIER. I would say selective. We will use those if we selectively see some significant advantage to us to pick up one of those milestones or two of those milestones in that period.

Mr. HULTGREN. Admiral Dyer, from your perspective on the safety advisor panel, what are the pitfalls do you think of this process?

Admiral DYER. I don't know that there are any that I haven't mentioned in terms of communications, et cetera, et cetera. It does touch on that what keeps you at night worry, though, and that is, there is tremendous pressure in any government agency and any government program to force fit the job to be done into the money available. So if money does run short, we worry that there may be an attempt to certify not via a FAR contract but via the Space Act agreements perhaps with a very limited demonstration of safety without the insight. That wouldn't be a good thing.

Mr. HULTGREN. Mr. Gerstenmaier, you mentioned kind of what your thoughts or expectations would be as far as the optional milestones go. I wonder would they really only become affordable if the Commercial Crew Program is funded at a higher level than it receives today?

Mr. GERSTENMAIER. As we project forward in our budget submit for 2013, you know, we are looking for \$829 million or so in fiscal year 2014, we think we need those funding levels. It is not clear that a funding level would directly tie to these milestones, in other words, if we had more funding, would we implement these milestones? I would look at it more from a technical benefit standpoint,

does this provide an ability to advance or to get more safety insight, does this give us an additional test that is critical to us. So it is kind of a—I don't know. We would look at them and evaluate whether it makes sense, so it is not tied to the overall funding level whether we would implement those optional milestones or not.

Mr. HULTGREN. If I can change direction just a little bit, while not directly related to today's hearing, I wondered, Mr. Gerstenmaier, if you could comment briefly on the current state of the J-2X engine?

Mr. GERSTENMAIER. The J-2X is doing extremely well down in Stennis. We fired that engine for, I believe, up to 19 minutes, which is one of the longest firings we have had in any liquid-engine test program. It is meeting all its milestones, all its performance activities. It is proceeding extremely well down in Stennis.

Mr. HULTGREN. I wonder if there any threat of money being redirected away from J-2X development toward some of these other programs?

Mr. GERSTENMAIER. Again, we need to look at the overall needs of the program of what the right approach is as we move forward for the heavy-lift launch vehicle. The upper stage clearly needs this J-2X engine if we are going to get into 130-metric-ton region. We can also get in that same lift capability by changing the boosters on the side of the SLS. We have an advanced booster contract to go take a look at that to see other liquid systems that may go on the side. So we are actively trading those back and forth. We may slow down the testing a little bit on J-2X if we think that gets us to a faster capability for SLS or we may keep it right at the same path we are on right now, but the intent is, I want to take J-2X until we have that system fully wrung out and ready to be an operable system for the future.

Mr. HULTGREN. Well, I see my time has just about run out. Thank you both. Thank you, Chairman. I yield back.

Chairman HALL. I thank you.

The Chair recognizes Ms. Adams, the gentlelady from Florida, for five minutes.

Mrs. ADAMS. Thank you, Mr. Chairman.

Mr. Gerstenmaier, can you describe the working relationship that NASA has with the CCIcap companies and how that relationship helps NASA guide the development of these new vehicles, especially since our biggest concern is that NASA does not have the authority to impose safety requirements at this stage in the development?

Mr. GERSTENMAIER. We have teams located at each one of the CCIcap providers. Those teams get insight into the daily activities and the design that is occurring and the work that is occurring on those designs as they are moving forward.

Mrs. ADAMS. Are you having open dialog with CCIcap?

Mr. GERSTENMAIER. We have full insight into what they are doing and what activity is going on. We don't have the control side but we have full insight into what they are doing.

Mrs. ADAMS. So you don't have a conversation back and forth?

Mr. GERSTENMAIER. I think that is probably a fair way of saying it.

Mrs. ADAMS. I want to talk about the cost of Atlas V rockets. The price of an Atlas has skyrocketed under the evolved expendable launch vehicle administered under the Air Force. My understanding is that the Commercial Crew Program will greatly lower the cost of crew launch for our Nation. However, NASA has selected two proposals that are using Atlas V vehicles. Is NASA somehow getting a cheaper price than the Air Force is getting? NASA paid over \$220 million per launch for the Atlas V rocket for the GOES-R and GOES-S missions. Is the cost similar to what we paid under the Commercial Crew Program, or what will be paid under Commercial Crew?

Mr. GERSTENMAIER. What we are doing under the Commercial Crew Program is, we are getting integrated service, which is transportation of crew to the ISS. It is then up to the commercial crew providers to negotiate with United Launch Alliance for the cost of the rockets that you described over the cost of the Atlas V. That is internal to their contract. What I am looking for is a total cost on the other side, and it would be best for you to talk to the individual CCiCap providers to get their insight into what their relationship is with United Launch Alliance.

Mrs. ADAMS. Okay. Do you believe it will be more cost-effective than what the U.S. Air Force is doing?

Mr. GERSTENMAIER. I don't have insight into that. I know what the seat price is on the other side or the anticipated seat price, and there needs to be some efficiency there. It does help in the sense that it is helping throughput through the system and that helps lower some of the marginal costs which could potentially benefit both sides. It could potentially also lower costs for other satellite providers as well as for us.

Mrs. ADAMS. If NASA receives level funding on the order of \$500, \$525 million over the next several years for Commercial Crew? Does the acquisition plan hold together; will you get the services agreement sometime in 2017?

Mr. GERSTENMAIER. As part of our budget submit, we will go look at some alternate funding scenarios and show you what is available at those various funding levels. I don't have that information, or I am not prepared to talk about it today.

Mrs. ADAMS. So you can't talk about whether you think you will get to a service agreement by some time in 2017?

Mr. GERSTENMAIER. Well, I think it would be better for us to take that for the record and then go ahead and actually put the numbers together and show you where it is as part of our PB14 activity.

Mrs. ADAMS. Okay. In the plan presented today, what would NASA reduce, eliminate or extend if the program is flat-funded?

Mr. GERSTENMAIER. Say the question again. In terms of—

Mrs. ADAMS. In the plan presented today, in the plan presented today, what would NASA reduce, eliminate or extend if the program is flat-funded?

Mr. GERSTENMAIER. Again, what we would do is, we would go look and see what our options are. If we say flat-funded, we would look into extension, we would look at other alternate activities. What we need to be cognizant of is what Admiral Dyer talked

about, if I get a certain funding, we need to go take a hard look at this and say is this something we can actually deliver.

Mrs. ADAMS. Are you not having contingency plans?

Mr. GERSTENMAIER. We have contingency plans but not of the level that you just described because I am still struggling with exactly what my fiscal year 2013 budget is. Is it 406, which it was back in 2012, or is it the Senate or the House version that sits out in front of us.

Mrs. ADAMS. Go back to the awards. If they were made under the FAR-based selection process, how would the decision process be different?

Mr. GERSTENMAIER. We followed a pretty rigorous process to do these funded Space Act awards. It didn't fall under the exact definition of the FAR activity. It has certain constraints. But the spirit and the intent of what we did in our reviews, the way we did our deliberations, the way I set up the teams, the way we did the evaluations, the way we did the criteria is all consistent with what the FAR was but we didn't follow the exact letter of the law of the FAR.

Mrs. ADAMS. But it is very close?

Mr. GERSTENMAIER. It is very close.

Mrs. ADAMS. Thank you, Mr. Chair. I will yield back.

Chairman HALL. The gentlelady yields back.

I think we are about out of soap here. We are going to have to quit washing pretty soon.

Mr. Gerstenmaier, I didn't get to have a question, but as I came back in, you were talking about how the Russians had supported the space station after the Columbia accident, and I guess my question is, how much can we rely on the Russians to supply Soyuz after 2016 even if NASA is no longer a customer there? It is my understanding we are paying them something in excess of \$50 million now and by then it will be around \$62 million.

Mr. GERSTENMAIER. Again, as we—

Chairman HALL. We are no longer buying seats unless we are.

Mr. GERSTENMAIER. We intend once we get our capability we would no longer purchase seats from the Russians. We have a problem in July 1 of 2016. We have the Iran-North Korea-Syria Non-proliferation Act which prohibits us from providing funding or even bartering for capability from the ISS. We are going to need some relaxation in that Act to continue to operate the space station with the Russians. So we could not—we are prohibited now from buying seats beyond that July 2016 date with the Russians currently. We anticipate that some legislation will get approved in the next year that may help us with that current problem.

Chairman HALL. Okay. I think that answers the question I had.

Ms. Edwards had a brief question to close on.

Ms. EDWARDS. Thank you.

Chairman HALL. Your time is up.

Ms. EDWARDS. I just adore him.

Chairman HALL. Go ahead.

Ms. EDWARDS. Thank you very much, Mr. Chairman.

Just to follow up on that, in terms of—so you will be seeking a waiver then for INKSNA, and if that is true, do you actually have

a legislative proposal? Because presumably that would need to happen at the end of 2012 or early next year, right?

Mr. GERSTENMAIER. We need it in the spring of next year, and we have been working with several folks and working internal to the Administration to get a proposal to come forward.

Ms. EDWARDS. Thank you. Mr. Gerstenmaier, it would just be really helpful to have that, especially if you look at our calendar this year and early next year. It would be helpful if we had something to bounce off of. Thank you.

Chairman HALL. Thank you for your brevity.

Now, the questions are completed, I presume. We have no one else. I want to thank the witnesses for their very valuable testimony, and if the Committee—any members of the Committee who are not here who have other business here have questions for you, we will submit them to you and would really appreciate your being able to answer them to us in writing. They will be submitted in writing, and we will keep the record open for two weeks for additional comments from other members.

We thank you again over and over for your testimony and for your time, and you are excused. This hearing is adjourned.

[Whereupon, at 11:03 a.m., the Committee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by Mr. William H. Gerstenmaier
Chairman Hall's QFRs for Gerstenmaier

If these CCIcap awards were made under a FAR-based selection process, how would the decision process been different? What additional aspects would NASA have had to consider under a FAR-based selection process? What factors were eliminated from consideration by the SAA-based selection decision that would have affected a FAR-based selection?

Were CCIcap participants advised on a minimal, optimal, or requested level of private investment?

How will NASA verify the level of private investment that is contributed to the program?

If NASA determines that the companies are not contributing the level of funds originally agreed to in the CCIcap proposals, what recourse will NASA take?

If the companies contributions are inadequate to ensure that the government's requirements and needs will be met, at what point in the process will NASA terminate the space act agreement?

Given that the Liberty launch vehicle proposal used NASA heritage solid rocket boosters, and the European Space Agency's Ariane 5 booster, and a crew capsule and launch abort system with NASA heritage, please explain why ATK's proposal ranked so low on technical rating?

The costs for Atlas 5 EELV have increased significantly, yet three of the CCIcap awardees are planning to use that launch vehicle. How does NASA expect to produce cost savings in the commercial crew program using the same launcher that the Air Force is seeing increase?

- Is NASA getting a cheaper price than the Air Force?

In your response to a question about the cost savings that have resulted from the commercial cargo program, you said, "In the case of cargo, I can't give you a specific number of what we saved, but if you look at the launch costs and the cargo delivery, it is substantially less by using the Space Act approach than actually acquiring the services under the FAR part 12 contract for the actual delivery of services. So that has been a significant savings to us." Under the FAR-based

Commercial Resupply Services contracts, what is NASA's negotiated composite cost per kilogram of payload?

In a follow up question about the cost savings that have resulted from the commercial cargo program, you said, "I think the risk in the case of cargo was schedule. We got the systems delivered to us later than we would have desired but we were able to extend the shuttle with an extra flight that made that risk tolerable to have that schedule delay acceptable to us overall." What was the cost of the extra shuttle missions that were required as a result of the delays of the commercial cargo program?

Your written testimony states that having dissimilar crew transportation services is 'critical' to effective utilization of the International Space Station. Is NASA committing to contracting with two launch services providers, or does it expect to only have one U.S. provider?

Based on NASA's CCiCap acquisition plan it appears the agency intends to solicit and award a services contract about half-way through the phase 2 certification contract. Please explain how NASA will evaluate the compliance and suitability of competing proposals when they are nine-months to one-year shy of completing their phase 2 work?

**Questions from Rep. Donna Edwards
To William Gerstenmaier**

1. As NASA has acknowledged, risks are higher using an SAA because the agency does not have approval authority over how companies are meeting those requirements.
 - a. How is NASA addressing the risk of commercial partners potentially not meeting NASA safety or performance requirements at the end of the base CCIcap period?
 - b. What will NASA do if designs produced do not meet NASA's safety and performance requirements and are deemed unacceptable?
 - c. If NASA requires redesign or rework of completed systems, what impact will this have on costs and schedule? Who will pay these added costs?
2. At the hearing, you indicated that NASA would consider using some of the CCIcap optional milestones.
 - a. Wouldn't funding any of the CCIcap optional milestones undercut the whole purpose of the FAR-based certification phase contracts, which is preserving NASA's ability to mandate that its requirements be met and to provide NASA with the documentable need to verify that fact?
 - b. Are there any conditions under which you would fund the optional milestone of a crewed flight to the ISS? If so, what are they?
3. ASAP testified that NASA's latest acquisition strategy seems like an overly complex approach.
 - a. If the rationale for switching to Space Act Agreements was funding uncertainty, what makes NASA believe that the FAR-based certification contracts won't be subject to that same funding uncertainty?
 - b. If NASA believes that FAR-based contracts are needed, why not make the whole acquisition FAR-based instead of the current patchwork approach?
4. Your Source Selection Statement identifies one of the five CCIcap strategic goals as "Achieving significant industry financial investment". Yet, it appears that on average, the companies are only willing to assume little more than a 10 percent share of the cost of developing their systems.
 - a. Given that, why did you accept any of their proposals?
 - b. Why didn't you either tell them that they had to contribute a higher cost share, or alternatively, scrap the SAA approach and go back to your FAR-based acquisition strategy, since the government is paying almost all of the development costs?
5. Your Acquisition Strategy White Paper states that to ensure NASA crew safety, *"CTS Certification will validate technical and performance requirements, verify compliance with requirements at the subsystem level, process level and safety*

product level, validate that the CTS operates in the appropriate environments, and accept residual risk to NASA based on the governance model."

- a. How does NASA establish when residual risk is deemed "acceptable" and "unacceptable"?
 - b. What relationship does that risk have to a governance model?
6. Almost all of the studies available to date examining the cost of commercial crew transportation systems on a per seat cost basis include, as a cost component, associated development costs. This makes sense since the eventual litmus test of which alternative is better requires consideration of the government's total investment. How will costs spent as part of NASA's commercial crew development activities--CCDev, CCDev2, CCiCap, CPC, and Certification Contract—factor into the comparison between the seat costs using commercial providers and that using the Russian Soyuz? If such development costs are not factored into the comparison, how can this be a credible comparison?
7. During the hearing, referring to the Soyuz, you indicated that you needed an alternate way to get to the ISS. You also said that your intent was to use the domestic commercial carrier for all transportation to and from the ISS and that Soyuz transportation would no longer be required.
 - a. With the possibility of a single commercial provider for operational services, wouldn't NASA be in the same position it is in currently, namely having no alternate way to the ISS?
 - b. Does this call for the establishment of a contingency approach in conjunction with the award for commercial crew services?
 - c. How would this affect what NASA needs as part of any potential INKSNA legislation?

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Congress of the United States
House of Representatives

Friday, September 14, 2012

QUESTIONS FOR THE RECORD
THE HONORABLE RANDY NEUGEBAUER (R-TX)
U.S. House Committee on Science, Space, and Technology

Recent Developments in NASA's Commercial Crew Acquisition Strategy

To Mr. Gerstenmaier and VADM Dyer:

NASA will allow companies to propose alternative standards to agency requirements. Assuming current standards reflect decades of experience gained from launching a variety of previous vehicles, what is the most effective and objective method of assessing the soundness of a proposed alternative standard? What steps will NASA take to ensure that adopting an alternative standard in no way diminishes the level of safety?

To Mr. Gerstenmaier:

Why isn't there more synergy and cross-investment between NASA's SLS and Orion programs and NASA's Commercial Crew program? Why hasn't NASA leveraged the investments from Constellation to support commercial crew designs?

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Responses by Vice Admiral Joseph W. Dyer, USN (Ret.)
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VADM Joseph W. Dyer USN, (Ret.), Chair

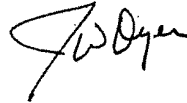
October 26, 2012

The Honorable Ralph M. Hall
Chairman
Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Hall:

Enclosed are the responses to the written questions submitted by the Members of the Committee on Science and Technology, resulting from the September 14, 2012 hearing regarding the *Recent Developments in NASA's Commercial Crew Acquisition Strategy*.

Sincerely,

A handwritten signature in black ink, appearing to read "J. W. Dyer", with a stylized flourish at the end.

VADM Joseph W. Dyer, USN (Ret.)
Chair

Enclosure

September 14, 2012 Hearing on
Recent Developments in NASA's Crew Acquisition Strategy

Response to Questions from Chairman Ralph Hall

1. To what degree does a launch vehicle's flight history mitigate the overall level of risk and the need for extensive certification work?

- Can commercial crew proposals from competing companies with markedly disparate flight histories of their launch systems, such as between the SpaceX Falcon 9 and the Atlas 5 EELV, be evaluated adequately and objectively?
- What priorities should the government consider in this process?
- Technically, flight history, or the lack thereof, doesn't change the inherent reliability or risk of a given design. It does, however, provide some insight into estimating that risk. Unfortunately, the number of flights required to give statistical confidence is often too high; this is especially true with expensive spacecraft. For flight history to be the primary basis of a safety certification, test cost would most probably eclipse any prior saving. Insight into the basic system design, component testing, configuration, manufacturing quality, and process techniques are required to provide the basis for certification.
- Yes, systems with markedly different flight histories can be evaluated adequately through a certification process that takes these factors into account. The fidelity of the input data must be known to be high. Timely development of that certification process and the associated criteria should be the top NASA priority to facilitate timely safety certification.

Response to Questions from Acting Ranking Member Donna Edwards

1. ASAP's May 2012 Quarterly Meeting minutes highlighted the importance of NASA laying out its requirements early to avoid *"the illusion of no need for certification because of a few early successes. Certain flight successes can play an important role in developing confidence in the design, but should not negate the need for a formal certification by the government."*

- a. Based on NASA's current acquisition approach, is ASAP still concerned about the agency possibly allowing "a few early successes" to substitute for meeting formal certification requirements?**
 - b. If so, what should Congress do in its oversight to address ASAP's concern and what NASA actions would satisfy ASAP?**
- a. Because senior NASA leadership understands that a few flight successes cannot substitute for a rigorous certification process, the panel is not as concerned about the agency making that mistake as we are concerned by the potential of those outside the agency doing so. The Panel is concerned there is risk of the agency being pressured to proceed without adequate evaluations based on a well-designed certification process.
 - b. Congress should provide adequate resources and time to conduct necessary insight and certification processes. The Phase 1 Certification Products Contract (CPC) should provide a good measure of what needs to be done and how long it will take.

2. ASAP's 2011 Annual Report stated, with regard to the change in acquisition strategy, that *"if NASA is deciding to take on more risk because the cost is otherwise prohibitive, then the Agency should be clear about that increased level of risk acceptance and develop approaches to manage that risk."*

- a. Has NASA established an acceptable risk level for commercial crew systems? If not, should it?**
 - b. Has NASA examined the cost of reducing risks? If not, should it?**
 - c. Does NASA have a way to establish when risks are excessive?**
 - d. What are ASAP's plans for continued review of the Commercial Crew Program with regards to safety and risks?**
- a. In July 2010, NASA established both "Threshold" and "Goal" probabilities for Loss Of Crew (LOC) for manned missions to the ISS. These values were ~1/300 as the maximum acceptable risk, or threshold, and ~1/1500 as an eventual or "mature system" goal. Because of the historical tendency to underestimate these risks at the start of complex programs, the Panel has stated that we would prefer more conservative and better defined values.
 - b. NASA has not completed a holistic, formal cost estimate for the overall Commercial Crew Program. The Panel believes a creditable cost estimate would be a great aid in making cost trades.
 - c. Technology exists for assessing the expected safety of rocket systems. NASA is currently in the process of developing policies and procedures for applying available techniques to the Commercial Crew agreements. The Panel has recommended that development of such certification policies and procedures be accelerated. The recently announced, FAR-based certification contracts have potential to accomplish this task.

- d. The ASAP intends to keep Commercial Crew as a prime focus. However, please note -- as an outside advisory panel, the ASAP is not chartered to do in-depth engineering analysis of the various systems. Properly, this must be a NASA undertaking.

3. During the hearing, in response to a Member question on NASA's plans regarding the CCiCap optional milestones under the SAAs, Mr. Gerstenmaier said that NASA might go forward with some of those milestones. In light of the concerns you expressed about the reduced oversight associated with SAAs, what is your view on even a selective use of these optional milestones? How would it affect the transition from the CCiCap under SAA to the FAR-based certification contracts NASA intends to award?

NASA has not yet developed plans for how they might exercise those options. Some, such as crewed flight, would require significant planning for how to gain sufficient insight to ensure the safety of such potential crew members and would require the delineation of explicit requirements and processes.

Response to Questions from Congressman Randy Neugebauer

1. NASA will allow companies to propose alternative standards to agency requirements. Assuming current standards reflect decades of experience gained from launching a variety of previous vehicles, what is the most effective and objective method of assessing the soundness of a proposed alternative standard? What steps will NASA take to ensure that adopting an alternative standard in no way diminishes the level of safety?

The standards that NASA has are based on a rich history of what can go right and what can go wrong in spaceflight. NASA personnel are highly experienced in the background of these standards as well as alternative means of meeting their intent. New, creative approaches for providing adequate safety at less cost, less weight, or simpler designs is one potential benefit from encouraging commercial approaches to space flight. NASA must remain rigorous, however, in evaluating these new concepts. Doing so will be time consuming, but should be possible. Deviation from or a waiver to any significant standard should require a rigorous analysis and risk assessment that will be compared against the requirements, such as clearly defined LOC and Loss of Mission (LOM) values. Any additional residual risk needs to be accepted by the appropriate level of authority and documented as to the rationale behind that acceptance.

Appendix II

ADDITIONAL MATERIAL FOR THE RECORD

SUBMITTED STATEMENT FOR THE RECORD BY REPRESENTATIVE JERRY COSTELLO

Chairman Hall, thank you for holding this important hearing.

I was encouraged by SpaceX's successful cargo demonstration last May and am looking forward to its upcoming launch of an operational cargo flight to the International Space Station (ISS) in October. I hope that Orbital Sciences will likewise be successful.

While these milestones should be commended, it is important to note that crewed flights are a lot more difficult than cargo flights. As commercial crew development advances, I am concerned with NASA's reversal in its commercial crew acquisition strategy—using Space Act Agreements (SAA), instead of Federal Acquisition Regulations (FAR)-based contracts for design activities and its possible affect on astronaut safety, which is of paramount importance.

Last year, NASA expressed to this committee that adherence to NASA's safety requirements could not be assured without using FAR-based contracts. NASA said that the risk of commercial partners' inability to meet its human-rating requirements could cause costly and time-consuming redesigns and pose safety concerns, thus requiring NASA to be more involved in the development of any commercial transportation system. As a result, NASA said Space Act Agreements could not be used.

Because NASA has since reversed itself by going back to using SAAs, I am eager to hear from our panel of experts on what this committee can expect going forward, whether astronaut safety is being compromised, and whether we can be assured that taxpayer funds are being spent wisely.

Mr. Chairman, I want to take a moment to recognize the loss of two American icons. Neil Armstrong and Sally Ride reminded us of the sheer ingenuity of the American public and the limitless possibilities available when Americans come together toward a common goal.

As his last hearing before this Committee, Mr. Armstrong cautioned that "NASA, with insufficient resources, struggles to fulfill the directives of the Administration and the mandates of the Congress. The result is a fractious process that satisfies neither." Acknowledging that progress is rapid and unstoppable in a technology-driven world he also said "Our choices are to lead, try to keep up, or get out of the way. A lead, however earnestly and expensively won, once lost, is very difficult and expensive to regain."

Their achievements, counsel and wisdom on space exploration speak to the importance of maintaining American preeminence in space flight and ensuring that NASA is adequately funded to meet future challenges.

Doing so would be a fitting way of honoring their courage, commitment, dedication, and exceptional accomplishments while maintaining American leadership in space exploration.

